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FROM

the Board of Agriculture.

30 June, 1890.

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TWENTY-EIGHTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

OF THE

STATE OF MICHIGAN

FROM

JULY 1, 1888, TO JUNE 30, 1889.

BY AUTHORITY.

LANSING:
DARIUS D. THORP, STATE PRINTER AND BINDER.
1889.

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REPORT OF THE SECRETARY

OF THE

STATE BOARD OF AGRICULTURE.

AGRICULTURAL COLLEGE,
July 1, 1889.

To HON. CYRUS G. LUCE,
Governor of the State of Michigan:

SIR—I have the honor to submit to you herewith, as required by statute, the accompanying report for the fiscal year ending June 30, 1889, with supplementary papers.

Very respectfully,
HENRY G. REYNOLDS,
Secretary of the State Board of Agriculture.

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STATE BOARD OF AGRICULTURE.

	Term expires.
Hon. FRANKLIN WELLS, Constantine,	1891
President of the Board.	
Hon. WM. B. McCREERY, Flint,	1893
Hon. CHAS. W. GARFIELD, Grand Rapids,	1893
Hon. OSCAR PALMER, Grayling,	1895
Hon. A. C. GLIDDEN, Paw Paw,	1895
Hon. I. H. BUTTERFIELD, Lapeer,	1891
Hon. CYRUS G. LUCE, Governor of the State, } Hon. O. CLUTE, M. S., President of the College, }	*Ex-officio.*

HENRY G. REYNOLDS, M. S., Agricultural College, Secretary.
BENJAMIN F. DAVIS, Lansing, Treasurer.

STANDING COMMITTEES.

The President of the Board is ex-officio a member of each of the Standing Committees.

Finance:	Wm. B. McCreery, A. C. Glidden.
Farm Management:	A. C. Glidden, I. H. Butterfield.
Botany and Horticulture:	C. W. Garfield, O. Palmer.
Buildings:	I. H. Butterfield, Wm. B. McCreery.
Employes:	O. Palmer, Wm. B. McCreery, O. Clute.
Farmers' Institutes,	A. C. Glidden, I. H. Butterfield.
Mechanics:	C. W. Garfield, O. Palmer.
Veterinary Dep't:	O. Palmer, I. H. Butterfield
College Land Grant:	Wm. B. McCreery, O. Palmer.
Military Dep't:	Wm. B. McCreery, C. W. Garfield.
State Weather Service:	A. C. Glidden, C. W. Garfield.
Experiment Station:	O. Palmer, A. C. Glidden.

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STATE AGRICULTURAL COLLEGE.

[UNDER CONTROL OF THE STATE BOARD OF AGRICULTURE.]

FACULTY AND OTHER OFFICERS.

O. CLUTE, M. S. President.
THEOPHILUS C. ABBOT, LL. D., Emeritus Professor of Mental Philosophy and Logic.
ROBERT C. KEDZIE, M. A., M. D., Professor of Chemistry and Curator of the Chemical Laboratory.
ALBERT J. COOK, M. S., Professor of Zoölogy and Entomology and Curator of the General Museum.
WM. J. BEAL, M. A., M. S., Ph. D., Professor of Botany and Forestry and Curator of the Botanical Museum.
ROLLA C. CARPENTER, M. S., C. E., M. M. E., Professor of Mathematics and Civil Engineering.
*SAMUEL JOHNSON, M. S., Professor of Practical Agriculture, and Superintendent of the Farm.
*ELIAS J. MACEWAN, M. A., Professor of English Language and Literature.
E. A. A. GRANGE, V. S., Professor of Veterinary Science.
HENRY G. REYNOLDS, M. S., Secretary.
WILLIAM F. DURAND, Ph. D., Professor of Mechanics, and Director of the Shops.
WENDELL L. SIMPSON, 2d Lieut. 24th Infantry, U. S. Army, Professor of Military Science and Tactics.
LEVI R. TAFT, M. S., Professor of Horticulture and Landscape Gardening, and Superintendent of the Horticultural Department.
FRANK S. KEDZIE, M. S., Assistant Professor of Chemistry.
HENRY R. PATTENGILL, B. S., Assistant Professor of English.
WILLIAM S HOLDSWORTH, B. S., Instructor in Drawing.
PHILIP B. WOODWORTH, B. S., Instructor in Physics.
CLARE B. WALDRON, B. S., Instructor in Botany.
HENRY THURTELL, B. S., Instructor in Mathematics.
HOWARD B. CANNON, B. S., Instructor in History.
FRANK H. HALL, B. S., Instructor in Mathematics.
ERNEST G. LODEMAN, Instructor in French and German.
†FRED H. HILLMAN, B. S., Instructor in Zoölogy.
†MISS MARY M. ABBOT, Librarian.
JUSTUS N. ESTABROOK, B. S., Assistant Secretary.
LOUIS KNAPPER, Florist.
CHARLES S. CRANDALL, B. S., Foreman of the Horticultural Department.
JAMES WISEMAN, Foreman of the Iron Shops and Engineer in Chief.
†HIRAM T. FRENCH, B. S., Assistant on Farm.
H. CAMPBELL, Carpenter and Foreman of the Wood Shops.
HENRY MUNN, Foreman of the Farm.
RICHARD HISCOCK, Engineer.
WILLIAM D. BROWN, Herdsman.

* Resigned to take effect Aug. 20, 1889.
† Resigned to take effect July 15.

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AGRICULTURAL EXPERIMENT STATION

OF THE

STATE AGRICULTURAL COLLEGE.

[UNDER CONTROL OF THE STATE BOARD OF AGRICULTURE.]

OFFICERS OF THE STATION.

O. Clute, M. S., - - - - - - - - - - - - Director.
Henry G. Reynolds, M. S., - - - - - - - - Secretary and Treasurer.
Samuel Johnson, M. S., - - - - - - - - - Agriculturist.
L. R. Taft, M. S., - - - - - - - - - - - Horticulturist.
Robert C. Kedzie, M. A., M. D., - - - - - - Chemist.
Albert J. Cook, M. S., - - - - - - - - - - Entomologist.
William J. Beal, M. A., M. S., Ph. D., - - - Botanist.
E. A. A. Grange, V. S., - - - - - - - - - - Veterinarian.
Hiram T. French, B. S., Assistant in - - - - Agriculture.
A. A. Johnson, B. S., Assistant in - - - - - Agriculture.
Charles S. Crandall, Assistant in - - - - Horticulture.
H. P. Gladden, B. S., Assistant in - - - - - Horticulture.
Frank S. Kedzie, M. S., Assistant in - - - Chemistry.
George L. Teller, B. S., Assistant in - - - - Chemistry.
A. B. Peebles, B. S., Assistant in - - - - - Chemistry.
Charles B. Cook, B. S., Assistant in - - - - Entomology.
A. B. Cordley, B. S., Assistant in - - - - - Entomology.
E. Davenport, M. S., Assistant in - - - - - Botany.
L. H. Dewey, B. S., Assistant in - - - - - Botany.
N. S. Mayo, B. S., D. V. S., Assistant in - - - Veterinary Science.
M. M. Abbot, - - - - - - - - - - - - - Librarian.

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STATE WEATHER SERVICE.

[UNDER CONTROL OF THE STATE BOARD OF AGRICULTURE.]

STANDING COMMITTEE IN CHARGE.

HON. A. C. GLIDDEN, - - - - - - - - - - - Paw Paw.
HON. CHAS. W. GARFIELD, - - - - - - - - - - Grand Rapids.
DIRECTOR, - - - - N. B. Conger, Serg't U. S. Signal Service, Lansing.
ASSISTANT, - - - - E. H. Nimmo, Lansing.

STATE INDEPENDENT FORESTRY COMMISSION.

This Commission is composed of the members of the State Board of Agriculture and has the following officers:

PRESIDENT, - - - - Hon. Franklin Wells, Constantine.
AUDITOR, - - - - - Hon. Wm. B. McCreery, Flint.
SECRETARY, - - - - Henry G. Reynolds, Agricultural College.
BOARD OF DIRECTORS, { Hon. Chas. W. Garfield, Grand Rapids.
Prof. Wm. J. Beal, Agricultural College.

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ACCOUNTS OF THE STATE AGRICULTURAL COLLEGE.

FOR THE FISCAL YEAR ENDING JUNE 30, 1889.

SECRETARY'S ACCOUNT.

				Dr.	Cr.
July 1, 1888.	To cash on hand			$3,857 11	
" "	To cash on deposit with College Treasurer, less $48.78 June interest and $4,086.32 outstanding warrants			3,086 01	
" "	By balance due students on deposit accounts			.....	$1,456 67
June 30, 1889.	To special appropriation receipts as per table No. 2, page 10:				
	From State Treasurer	$32,899 52			
	From Institution	18,589 60			
				51,489 12	
June 30, 1889.	By special appropriation disbursements			.....	56,070 62
" "	To current account receipts as per table No. 3, page 12:				
	From State Treasurer	$31,888 12			
	From Institution	9,956 68			
				41,844 80	
June 30, 1889.	By current account disbursements			.....	45,289 97
" "	To balance due students on deposit accounts			3,281 77	
" "	By cash on hand			.....	707 80
" "	By cash on deposit with College Treasurer, less $15.40 June interest, and $1,147.16 outstanding warrants			.....	33 75
				$103,558 81	$103,558 81

The above statement may, perhaps, be more easily understood from the following:

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TABLE NO. 1.—*Tabular Exhibit of Secretary's Account.*

Name of Account.	Balance Sheet, July 1, 1888.		Transactions July 1, 1888, to June 30, 1889.		Balance Sheet, June 30, 1889.	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Cash	$3,857 11			* $3,149 31	$707 80	
College treasurer	† 3,066 01			* 3,052 26	† 33 75	
Students' deposits		$1,456 67		* 1,825 10		$3,281 77
Special appropriations		4,946 70	$56,070 62	51,489 12		365 20
Current account		539 75	45,289 97	41,844 80	2,905 42	
Totals	$6,943 12	$6,943 12	$101,360 59	$101,360 59	$3,646 97	$3,646 97

* Balance of Dr. and Cr. transactions.

† Treasurer's statement is greater July 1, 1888, by $48.78, interest for June, 1888, not entered above, and by $1,066.32, June warrants still outstanding at close of month; and June 30, 1889, by $15.40, interest for June, 1889, not entered above, and by $1,147.16 warrants outstanding at close of month.

SUMMARY OF TREASURER'S REPORT.

B. F. Davis in Account with Agricultural College.

	Dr.	Cr.
To balance July 1, 1888	$7,221 11	
To receipts from State Treasurer and Secretary of State Board of Agriculture from July 1, 1888, to June 30, 1889	89,863 80	
To interest on deposits 12 months @ 4 per cent	389 26	
By warrants paid from July 1, 1888, to June 30, 1889		$96,277 86
By balance on hand June 30, 1889		1,196 31
	$97,474 17	$97,474 17

The above is a correct summary of my report to the State Board of Agriculture.

B. F. DAVIS, Treasurer.

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TABLE NO. 2.—*Statement of Special Appropriation Account for Fiscal Year July 1, 1888, to June 30, 1889.*

Name of Appropriation.	Balance of Account, July 1, 1888.		Receipts During year.		Total Available.	Total Expended.	Balance of Account, June 30, 1889.		Total Appropriation for 1889-1890.	Balance of Appropriation in State Treasury, June 30, 1889.
	Dr.	Cr.	From State Treasurer.	From Institution.			Dr.	Cr.		
Weather service, telephone and telegraph		$63 33	$2,218 27		$2,281 60	$1,452 86		$828 74	$3,000 00	$2,250 00
" " voluntary observers.			465 00		465 00	136 50		328 50	1,860 00	1,395 00
" " incidental expenses		277 98	222 50	$1 25	501 73	403 92		97 81	890 00	667 50
" " salary of director			200 00		200 00	200 00			800 00	600 00
" " salary of assistant		88 88	850 00		938 88	838 88		100 00	1,800 00	1,350 00
Farm department, drainage & perm't imp't		132 41			132 41	18 98		113 43		
" " hand implements		42 00	100 00		142 00	60 00		82 00		
" " two sets harness		34 00			34 00	34 00				
" " lumber		56 24	100 00		156 24	67 54		88 70		
" " furnishing farm house		47 49	100 00		147 49	147 49				
" " class room apparatus		45 86	150 00		195 86	159 39		36 47		
" " laboratory									8,000 00	8,000 00
" " appropriation of 1889			200 00		200 00			200 00	800 00	600 00
Horticultural department			125 00		125 00	100 41		24 59	500 00	375 00
" " culvert		78 09			78 09	34 25		43 84		
" " barn		91 30			91 30	14 55		76 75		
" " laboratory		948 14	2,500 00		3,443 14	3,443 14				
" " " furnish'g			500 00		500 00	485 20		14 80	500 00	
Green house		44 25	150 00		194 25	98 10		96 15	600 00	450 00
Mechanical department		526 80	800 00	42 71	1,369 51	1,282 41		87 10	3,200 00	2,400 00
Repairs of buildings			1,250 00		1,250 00	681 74		568 26	5,000 00	3,750 00
Contingent building fund		5,048 99		1,753 77	6,802 76	7,468 93	$666 17			

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Steam works	.....	308 52	1,000 00	.....	1,308 52	1,362 37	$53 85	.....	2,920 00	2,920 00
Mathematical and engineering department	.....	46 72	118 75	.....	165 47	88 11	.....	77 36	475 00	356 25
Botanical department	.....	.....	250 00	31 00	281 00	161 25	.....	119 75	1,000 00	750 00
Veterinary department	.....	61 38	50 00	.....	111 38	80 84	.....	30 54	200 00	150 00
Chemical department	.....	698 65	375 00	.....	1,073 65	1,082 87	.....	40 78	1,500 00	1,125 00
Zoological department	.....	82 71	375 00	.....	457 71	288 60	.....	169 11	1,500 00	1,125 00
English department	.....	83 50	37 50	.....	121 00	89 36	.....	31 64	150 00	112 50
Military department	.....	71 22	250 00	.....	321 22	124 40	.....	196 82	100 00	100 00
Library	.....	29 24	1,750 00	98 23	1,877 47	1,405 89	.....	471 58	3,000 00	2,250 00
Farmers' Institutes	.....	.....	400 00	.....	400 00	314 60	.....	85 40	800 00	400 00
Fire escapes	.....	312 69	.....	.....	312 69	276 77	.....	35 92	.....	.....
Drafting department	.....	.....	62 50	.....	62 50	.....	.....	62 50	250 00	187 50
Dormitory	$1,644 88	.....	6,500 00	.....	4,855 12	4,855 12	.....	.....	.....	.....
" heating	.....	.....	1,300 00	.....	1,300 00	1,300 00	.....	.....	1,300 00	.....
Apartment building	.....	184 15	6,500 00	.....	6,684 15	6,684 15	.....	.....	.....	.....
Student labor (see Table No. 5, page 13)	.....	942 04	4,000 00	.....	4,942 04	4,215 36	.....	726 68	8,000 00	6,000 00
Experiment station	3,750 00	.....	* 15,000 00	1,662 64	12,912 64	16,662 64	3,750 00	.....	.....	.....
Balances	4,946 70	.....	.....	.....	.....	.....	365 20	.....	.....	.....
Totals	$10,341 58	$10,341 58	*$47,899 52	$3,589 60	$56,485 82	$56,070 62	$4,835 22	$4,835 22	$48,145 00	$37,313 75

* $15,000.00 from U. S. Treasurer.

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TABLE NO. 3.—*Current Account, July 1, 1888, to June 30, 1889.*

On Account of—	Dr. To Disbursements.	Cr. By Receipts.
State Treasurer, interest on proceeds of sales of U. S. land grant, see Table No. 12, page 17	.....	$31,888 12
Students' fees, of which $1,224.50 is transferred to special contingent building fund, see Table No. 5, page 13	.....	6,724 76
Salaries, see Table No. 7, page 14	$28,183 32	.....
Farm Department, see Table No. 8, page 15	3,537 34	2,730 28
Horticultural Department, see Table No. 9, page 15	1,952 90	907 52
Green-house Department	670 32	238 90
Mechanical Department	743 42	36 57
Heating, lighting, cleaning and repairs	6,825 77	482 22
Academic Departments	1,080 67	.....
Offices, postage, stationery, advertising and sundry	2,346 23	60 98
State swamp land grant sale, transferred to special contingent building fund	.....	10 50
Interest and exchange, transferred to special contingent building fund	.....	518 77
Totals	$45,289 97	$13,596 57
Transferred to special contingent building fund	1,753 77	.....
Balance at beginning of period, July 1, 1888	.....	539 75
Balance at close of period, June 30, 1889	.....	2,905 42
Footings	$47,043 74	$47,043 74

TABLE NO. 4.—*Experiment Station Account, July 1, 1888, to June 30, 1889.**

On Account of—	Dr. To Disbursements.	Cr. By Receipts.
U. S. Treasurer, annual appropriation	.....	$15,000 00
Fertilizer license fees and expenses	$283 65	800 00
Salaries	6,869 74	.....
Farm Department	3,295 10	786 45
Horticultural Department	818 58	5 04
Chemical Department	551 81	.....
Botanical Department	766 08	30 40
Zoological Department	374 51	27 00
Veterinary Department	724 78	10 00
Buildings	509 08	.....
Library	562 64	.....
Offices, &c.	384 33	3 75
Grayling station	936 61	.....
Other outlying stations	585 73	.....
	$16,662 64	$16,662 64

* For fuller details of this account see the special report of the Experiment Station in the body of this volume.

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TABLE NO. 5—*Students' Fees.*

	Current Account.	Special Account, Conting't Building Fund.
Room rent	$3,119 41	.....
Incidental expense fee	1,828 75	.....
Damages	6 13	.....
Physiological dissection fee	35 00	.....
Veterinary dissection fee	16 00	.....
Chemical analysis fee	494 97	.....
Special examination fee	.....	$62 00
Matriculation fee	.....	685 00
Diploma fee	.....	160 00
Tuition fee from non-resident students	.....	367 50
Totals	$5,500 26	$1,224 50

TABLE NO. 6.—*Student Labor.—Account of Wages paid for 12 Months, July 1, 1888, to June 30, 1889.*

	Special Appropriation.	Experiment Station.	Current Account.	Total.
Farm Department	$599 50	.....	.....	$599 50
Horticultural Department	1,304 66	.....	.....	1,304 66
Green-house Department	201 76	.....	.....	201 76
Mechanical Department and repairs	424 68	.....	$11 05	435 73
Signal flags	37 24	.....	.....	37 24
Bell ringing, choir, etc	160 32	.....	71 92	232 24
Janitor	853 89	.....	24 37	878 26
Offices	76 46	.....	15 72	92 18
Veterinary Department	28 00	.....	.....	28 00
Zoological Department	63 37	$62 16	16 16	141 69
Botanical Department	108 72	6 12	.....	114 84
Chemical Department	136 04	.....	.....	136 04
Military Department	79 84	.....	.....	79 84
Library	140 88	.....	.....	140 88
Total	$4,215 86	$68 28	$139 22	$4,422 86

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TABLE NO. 7.—*Salaries.*

	Paid From			Total.
	Current Account.	Experiment Station Account.	Other Sources.	
President, dwelling and	$3,200 00			$3,200 00
One Professor, dwelling and	1,400 00	$600 00		2,000 00
One Professor on half pay	1,000 00			1,000 00
Four Professors, dwelling and $1,800 each	4,800 00	2,400 00		7,200 00
Three Professors, dwelling and $1,800 each	5,400 00			5,400 00
* One Professor, dwelling and			$1,828 00	1,828 00
One Professor	1,200 00	300 00		1,500 00
One Assistant Professor	1,200 00	300 00		1,500 00
One Assistant Professor	1,200 00			1,200 00
One Instructor, rooms and	800 00			800 00
One Instructor, rooms and	600 00			600 00
Four Instructors, rooms and $500 each	2,000 00			2,000 00
Two Instructors, rooms and $300 each	600 00			600 00
§ Secretary, dwelling and		500 00	1,000 00	1,500 00
Assistant Secretary, rooms and	600 00			600 00
Librarian, rooms and	380 00	120 00		500 00
Foreman of Farm, dwelling, board and	600 00			600 00
Foreman of Garden, rooms and	750 00	250 00		1,000 00
Foreman of Iron Shop, dwelling and	900 00			900 00
Foreman of Wood Shop, rooms and	700 00			700 00
Florist, dwelling and	750 00			750 00
Two Assistant Florists, rooms and	415 00			415 00
One Assistant in Experiments, room and	300 00	300 00		600 00
Two Assistants in Experiments, rooms and $500 each	200 00	800 00		1,000 00
Six Assistants in Experiments, rooms and $300 each		1,800 00		1,800 00
One Assistant in Experiments, room and		156 00		156 00
† Engineer			500 00	500 00
Herdsman, dwelling and	450 00			450 00
† Fireman			360 00	360 00
Total	$29,445 00	$7,526 00	$3,688 00	$40,659 00

* Army officer detailed as Professor of Military Science and Tactics. Salary paid by U. S. Government.
§ $1,000 of salary as Secretary of the Board of Agriculture is paid from the State Treasury.
† Paid from special appropriation for steam works.

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TABLE NO. 8.—*Account with Farm Department.*

On Account of—	Dr. To Disbursements.	Cr. By Receipts.
Labor and team, aside from student labor	$1,364 16	$105 16
Farm house	852 34	362 75
Cattle	767 48	873 77
Sheep	25 05	372 71
Swine	49 91	293 17
Grain	130 05	443 68
Produce	2 30	31 08
Implements and repairs	233 31	34 00
Wood	.....	136 96
Fertilizer	34 88	77 00
Office, etc.	77 86	.....
Balance	.....	807 06
Footings	$3,537 34	$3,537 34

TABLE NO. 9.—*Account with Horticultural Department.*

On Account of—	Dr. To Disbursements.	Cr. By Receipts.
Labor, aside from student labor	$962 30	.....
Team	475 99	.....
Grounds	179 63	.....
Vegetable garden	90 53	.....
Fruit garden	6 30	.....
Implements and repairs	123 96	.....
Ice	46 20	.....
Office, etc.	67 79	.....
Sundry receipts	.....	$907 52
Balance	.....	1,045 38
Footings	$1,952 90	$1,952 90

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TABLE NO. 10.—*Agricultural College Lands, United States Grant, Record of Sales and Forfeitures to the Present Time.*

Number of Acres sold at Original Sale.				Forfeited Lands Resold.			Total Sales.			Number of Acres Reverting by Forfeiture.	Aggregate of Sales, less Forfeitures to end of each Year, Acres.	Balance Remaining Vacant at end of each Year, Acres.
Year.	Acres.	Average Price Per Acre.	Amount.	Acres.	Average Price Per Acre.	Amount.	Acres.	Average Price Per Acre.	Amount.			
1867												235,682.46
1868	520.	$5 00	$2,600 00				520.	$5 00	$2,600 00		520.	235,162.46
1869	13,480.	3 19	43,000 00				13,480.	3 19	43,000 00		14,000.	221,682.46
1870	3,280.	3 44	11,280 00				3,280.	3 44	11,280 00		17,280.	218,402.46
1871	9,372.44	3 37	31,637 32				9,372.44	3 37	31,637 32		26,652.44	209,030.02
1872	20,580.25	3 19	65,660 75				20,580.25	3 19	65,660 75		47,232.69	188,449.77
1873	17,205.89	3 15	54,177 67	40.	$3 62	$145 00	17,245.89	3 15	54,322 67	40.	64,438.58	171,243.88
1874	2,089.95	3 20	6,519 75	40.	3 00	120 00	2,079.95	3 19	6,639 75	638.72	65,879.81	169,802.65
1875	4,798.99	3 08	14,796 97	40.	3 00	120 00	4,838.99	3 08	14,916 97	560.	70,158.80	165,523.66
1876	1,953.73	3 12	6,101 19	520.	4 38	2,280 00	2,473.73	3 39	8,381 19	1,758.40	70,874.18	164,808.33
1877	1,634.75	3 00	4,904 25	200.	3 00	600 00	1,834.75	3 00	5,504 25	1,438.06	71,270.82	164,411.64
1878	4,034.80	3 10	12,504 40	1,135.73	3 91	4,443 65	5,170.53	3 28	16,948 05	2,415.73	74,025.62	161,656.84
1879	6,782.12	3 02	20,506 36	1,318.06	3 08	4,054 18	8,100 18	3 03	24,560 54	1,978.11	80,147.69	155,534.77
1880	8,826.56	3 03	26,729 58	280.	3 18	890 00	9,106 56	3 03	27,619 58	4,926.33	84,327.92	151,354.54
1881	6,168.97	3 96	24,447 25	360.	4 33	1,560 00	6,528.97	3 98	26,007 25	1,967.19	88,869.70	146,813.76
1882	10,225.99	5 00	51,129 95	1,637.01	5 09	8,335 05	11,863.	5 01	49,465 00	760.11	99,972.59	135,709.87
1883	7,085.57	5 00	35,177 85	1,630.	5 03	8,448 00	8,715.57	5 00	43,625 85	530.	108,128.16	127,554.30
1884	1,846.01	5 09	9,390 05	526.45	5 38	2,832 25	2,372.46	5 15	12,222 30	200.	110,300.62	125,381.84
1885	704.88	5 74	4,044 40	119.52	5 67	677 80	824.40	5 73	4,722 00	525.47	110,599.55	125,082.91
1886	720.00	5 83	4,200 00	560.	5 78	3,240 00	1,280.00	5 81	7,440 00	440.	111,459.55	124,242.91
1887	1,718.27	6 45	11,091 35	320.	5 00	1,600 00	2,038.27	6 23	12,691 35	200.	113,277.83	122,404.64
1888	2,031.18	6 02	12,235 90	160.	5 00	800 00	2,191.18	5 95	13,035 90	640.	114,829.00	120,853.46
1889	1,000.28	6 64	6,641 40	40.	5 00	200 00	1,040.28	6 58	6,841 40	120.	115,749.28	* 119,963.18
Total	125,960.63	$3 64	$458,776 39	8,976.77	$4 49	$40,345 78	134,937.40	3 70	$499,122 12	19,188.12		

* See Table No. 16 on page 19.

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TABLE NO. 11.—*Agricultural College Trust Fund.*

Year.	Receipts of State Land Office on account of Principal for Agricultural College Lands Sold.	Refunded on account of erroneous payments.	Balance transferred to credit of Agricultural College Trust Fund.	Aggregate to credit of Agricultural College Trust Fund at close of each fiscal year.
1868	$2,300 00		$2,300 00	
1869	11,865 00		11,865 00	$14,165 00
1870	5,895 00		5,895 00	20,060 00
1871	20,101 58		20,101 58	40,161 58
1872	33,621 93	$174 54	33,447 39	73,608 92
1873	29,583 47		29,583 47	103,192 39
1874	4,686 75		4,686 75	107,879 14
1875	5,399 24		5,399 24	113,278 38
1876	5,939 30	390 00	5,549 30	118,827 68
1877	2,337 22		2,337 22	121,164 90
1878	9,619 99		9,619 99	130,784 89
1879	8,590 53		8,590 53	139,375 42
1880	13,762 28		13,762 28	153,137 70
1881	20,241 18	60 00	20,281 18	173,418 88
1882	51,449 27		51,449 27	224,868 15
1883	34,482 28	825 90	33,656 38	258,524 53
1884	13,802 87		13,802 87	272,327 40
1885	12,460 87		12,460 87	284,788 27
1886	16,545 31		16,545 31	301,333 58
1887	26,731 62		26,731 62	328,065 20
1888	18,122 35		18,122 35	346,187 55
1889	11,431 65		11,431 65	357,619 20

NOTE.—Fifteen thousand dollars of the above fund was invested from 1870 to 1871 in War Bounty Bonds and held by the College.

TABLE NO. 12.—*Agricultural College Interest Fund.*

Year.	Interest on Agricultural College Fund, at 7 per cent. paid by State Treasurer from Specific Tax Fund.	Interest from purchasers on balances due on certificates for part-paid land, less refundings and expenses for Appraisals, etc. †	Receipts for Penalty.	Trespass Collections.	Total accrued to credit of Agricultural College each year.	Amount paid over to Treasurer of Agricultural College.	Balance remaining to credit of Agricultural College Interest Fund at close of each fiscal year.
1869		$56 68	$2 28		$58 96		$58 96
1870	*$374 95	1,789 56	56 42		2,720 93	$2,779 89	
1871	$1,397 97	2,317 24	70 63		3,785 84	2,976 00	809 84
1872	3,953 17	3,099 51	122 97		7,175 65	6,774 47	1,211 02
1873	6,040 33	4,907 77	110 96		11,059 06	12,238 48	31 60
1874	7,407 65	6,499 21	155 12		14,061 98	11,896 00	2,197 58
1875	7,717 24	6,552 93	125 97	$50 00	14,446 14	14,458 00	1,987 72
1876	8,124 31	6,692 47	306 64	1,706 75	16,830 17	18,817 89	
1877	8,396 64	5,726 58	189 64	860 00	15,172 86	15,172 86	
1878	8,740 62	6,405 26	247 21	414 00	15,807 09	13,320 61	2,486 48
1879	9,409 73	6,664 80	276 55	627 14	16,978 22	16,602 02	2,862 68
1880	10,240 28	7,333 23	148 73	115 00	17,837 24	17,799 15	2,900 77
1881	11,426 96	8,642 08	285 47	580 77	20,935 25	20,451 85	3,384 17
1882	13,957 04	8,345 45	204 96		22,507 45	25,891 62	
1883	16,741 38	9,141 80	206 96	4,659 96	30,749 60	26,139 13	4,610 47
1884	18,739 02	8,881 98	287 56	51 16	27,909 72	27,402 94	5,117 25
1885	19,645 33	9,121 14	329 06	674 87	29,770 40	29,599 97	5,287 68
1886	20,571 65	9,323 98	565 41		30,461 04	29,920 68	5,828 04
‡1887	16,493 98	7,577 57	309 84	229 96	24,611 37	19,761 06	10,678 35
1888	23,425 64	7,310 84	394 85	1,275 27	32,406 60	32,006 10	11,078 85
1889	24,551 32	6,826 39	320 23	124 75	31,822 69	31,888 12	10,513 42

*This amount was interest on war bounty bonds in which the fund was invested at the time.
$525 of this was interest on war bounty bonds in which the fund was invested part of the year.
†Refundings amounted to $364.87, ranging from nothing in 1880 to $145.21 in 1874. Appraisal expenses amounted to $1,289.88, ranging from nothing in 1872 to $208 94 in 1886. Advertising amounted to $896.80, ranging from nothing in 1870 to $218.35 in 1884. Trespass examination amounted to $4.00 in 1883.
‡Nine months.

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TABLE No. 13.—*Showing by counties the amount of Agricultural College Land sold at original sale during the fiscal year ending June 30, 1889.*

Counties.	Acres.	Price per Acre.	Purchase Price.	Amount Paid.	Amount Due.
Alcona	400.28	$5 00	$2,001 40	$2,001 40	.....
Cheboygan	40.00	6 00	240 00	240 00	.....
	40.00	7 00	280 00	280 00	.....
Montmorency	40.00	5 00	200 00	50 00	$150 00
Oscoda	80.00	8 00	640 00	640 00	.....
	40.00	5 00	200 00	200 00	.....
Otsego	40.00	5 00	200 00	200 00	.....
Wexford	80.00	6 00	480 00	480 00	.....
	80.00	5 00	400 00	400 00	.....
	160.00	12 50	2,000 00	1,500 00	500 00
Totals	1,000.28	$6 64	$6,641 40	$5,991 40	$650 00

TABLE No. 14.—*Showing by counties the amount of Forfeited Agricultural College Land sold during the fiscal year ending June 30, 1889.*

County.	Acres.	Price per Acre.	Purchase Price.	Amount Paid.	Amount Due.
Montmorency	40.00	$5 00	$200 00	$50 00	$150 00
Totals	40.00	$5 00	$200 00	$50 00	$150 00

TABLE No. 15.—*Showing, by counties, the amount of Agricultural College Land forfeited to the State during the fiscal year ending June 30, 1889.*

Counties.	No. of Acres.
Kalkaska	40
Montmorency	80
Total	120

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TABLE NO. 16.—*Showing by counties the Sales and Forfeitures during the year and the amount of land vacant at the beginning and end of the year.*

Counties.	Reported by the Land Office.				Balance remaining unsold June 30, 1889, if columns 1 to 4 are correct.	Balance remaining unsold June 30, 1889, as reported by the Land Office.	*Discrepancy between columns 5 and 6.	
	Acres Vacant June 30, 1888.	Acres Reverting by Forfeiture During fiscal year ending June 30, 1889.	Aggregate of Columns 1 and 2, being Total Acres subject to sale during year ending June 30, 1889.	Acres sold during fiscal year ending June 30, 1889.			Shortage.	Excess.
Alcona	20,688.14	.....	20,688.14	400.28	20,287.86	20,059.94	227.92	.....
Alpena	920.	.....	920.	.....	920.	920.	.....	.....
Antrim	3,120.93	.....	3,120.93	.....	3,120.93	3,120.93	.....	.....
Benzie	4,480.	.....	4,480.	.....	4,480.	4,400.	80.	.....
Charlevoix	3,685.09	.....	3,685.09	.....	3,685.09	3,685.09	.....	.....
Cheboygan	5,091.10	.....	5,091.10	80.	5,011.10	5,011.10	.....	.....
Gd. Traverse	440.	.....	440.	.....	440.	440.	.....	.....
Iosco	26,666.98	.....	26,666.98	.....	26,666.98	26,666.98	.....	.....
Kalkaska	1,000.68	40.	1,040.68	.....	1,040.68	1,000.68	40.	.....
Manistee	5,960.	.....	5,960.	.....	5,960.	5,960.	.....	.....
Missaukee	799.64	.....	799.64	.....	799.64	799.64	.....	.....
Montmorency	7,644 80	80.	7,724.80	80.	7,644.80	7,604.80	40.	.....
Oscoda	13,771.86	.....	13,771.86	120.	13,651.86	13,732.46	.....	80.60
Otsego	3,744.74	.....	3,744.74	40.	3,704.74	3,704.74	.....	.....
Presque Isle	320.	.....	320.	.....	320.	320.	.....	.....
Wexford	22,520.	.....	22,520.	320.	22,200.	22,160.	40.	.....
Total	120,853.46	120.	120,973.46	1,040.28	119,933.18	119,585.86	347.32	.....

* This discrepancy, as well as the one noted on page 24 of the Report of the Board of Agriculture for 1888, has been pointed out to the Deputy Commissioner of the Land Office, but up to the time of publication of this Report no explanation has been made.

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SUMMARY OF INVENTORY, JUNE 30, 1889.

College farm and park, 676 acres @ $70		$47,320 00
Buildings—		
College hall	$15,000 00	
Williams hall	45,000 00	
Wells hall	25,000 00	
Abbot hall	13,000 00	
Library and museum building	25,000 00	
Chemical laboratory	18,000 00	
Botanical laboratory	6,000 00	
Mechanical laboratory	10,800 00	
Veterinary laboratory	5,400 00	
Horticultural laboratory	6,000 00	
Armory and assembly hall	6,000 00	
Farm house	3,500 00	
Four brick houses @ $3,000	12,000 00	
Two brick houses @ $3,500	7,000 00	
President's and two frame houses	20,728 00	
One frame house	4,000 00	
Apartment building and out building	14,500 00	
Herdsman's house	600 00	
Ten barns at Professors' houses @ $250	2,500 00	
Horticultural barn and shed	1,500 00	
Cattle barn and shed	3,800 00	
Sheep barn	2,500 00	
Horse barn	3,000 00	
Piggery	2,000 00	
Brick work-shop	600 00	
Corn-house	500 00	
Green-house, furnaces, dwelling and stable	10,450 00	
Feed barn	1,200 00	
Grain barn	1,600 00	
Tool-house	1,300 00	
Observatory	150 00	
Boiler-house and chimney	5,000 00	
New bee-house	600 00	
Old bee-house	280 00	
		274,508 00
Iron bridge over Cedar river		1,000 00
Water works—		
Artesian well and connections	$1,000 00	
Two pumps, $900 and $500	1,400 00	
2,378 feet six-inch wood pipe in place	1,426 80	
2,623 feet four-inch wood pipe in place	1,049 20	
662 feet three-inch wood pipe in place	198 60	
12 fire hydrants in place	480 00	
Valves, fittings and connections	994 40	
Water tank and heater for same	550 00	
700 feet fire hose, 2 carts, nozzles, etc.	671 45	
		7,770 45
Steam works—		
Four boilers 4 ft. x 12 ft. each @ $600	$2,400 00	
Two boilers 5 ft. x 12 ft. each @ $925	1,850 00	
Underground piping	2,700 00	
Two small steam pumps $110 and $200	310 00	
Pipes and fittings	405 62	
Tools for steam fitting	322 55	
		7,988 17
Ten dozen tackle fire escapes		120 00
Ten fire extinguishers		400 00
Fuel on hand, 100 tons bituminous coal @ $3.50		350 00
Footing carried forward		$339,456 62

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INVENTORY.—*Continued.*

Brought forward		$339,456 62
Farm Department—		
Cattle, 57 head	$6,530 00	
Horses, 6 head	775 00	
Sheep, 62 head	563 00	
Swine, 31 head	265 00	
Implements, produce, etc.	7,670 90	
		15,803 90
Horticultural Department—		
Team, harness, etc.	$718 00	
Tools	925 75	
Vegetable garden	180 75	
Miscellaneous	529 70	
		2,354 20
Green-house—		
Plants	$5,086 10	
Implements	502 55	
		5,588 65
Mechanical Department—		
Wood shop	$1,815 44	
Iron shop	5,232 46	
Blacksmith shop	284 45	
Physical apparatus	1,293 39	
		8,625 74
Chemical Department—		
Furniture, fixtures, engine and tools	$2.877 82	
Physical apparatus	5,596 51	
Chemical apparatus and chemicals	4,791 90	
		13,266 23
Mathematical and Engineering Department—		
Surveying instruments, etc.	$1,380 59	
Telescope, magic lantern, views, etc.	1,232 65	
Testing machine	508 00	
		3,121 24
Botanical Department—		
Museum	$3,885 00	
Microscopes and class-room apparatus	1,767 43	
Office furniture and fixtures	35 00	
Herbarium	1,747 07	
		7,434 50
Library—		
Books and pamphlets	$21,085 00	
Furniture	1 858 00	
		22,943 00
Veterinary Laboratory—Museum, furniture and apparatus		2,145 65
Zoölogical Department—Furniture and apparatus		919 60
General museum—Collections and cases		14,633 00
College Hall—Furniture		1,097 14
Williams Hall—Furniture and club equipments		412 35
President's office		254 90
Secretary's office		571 50
Armory—Furniture, military equipments and gymnastic apparatus		639 50
Flag-staff and flags		175 00
Apiary—Bees, stock, etc., not belonging to Experiment Station		358 00
Experiment Station, not including items separately mentioned above		8,279 40
		$448,080 12

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EXPERIMENT STATION INVENTORY.

Included in the above total of $448,080.12 is $12,733.40 which belongs to the Experiment Station, consisting of the following items:

Lands donated to the Station—		
80 acres at Grayling, fenced and improved	$1,850 00	
10 " " Harrison, " " "	300 00	
10 " " Oscoda, " " "	120 00	
		$2,270 00
Buildings—		
Experimental feed barn	$1,200 00	
Horticultural laboratory, experimental rooms	1,200 00	
Apiary	600 00	
		3,000 00
Library and offices—		
Books	$1,085 00	
4 book-cases, 4 doz. filing boxes, carpet, stationery, etc.	369 00	
		1,454 00
Farm Department—		
Implements	$140 36	
13 steers for feeding experiment	650 00	
9 heifers and 1 bull for dairy experiment	850 00	
Feed and office equipment	339 00	
		1,979 36
Horticultural Department—		
Implements	$175 00	
Microscope, camera, balances, etc.	494 25	
		669 25
Chemical Department—		
Sundry apparatus	$617 37	
Chemical and physical balances	529 20	
Horse tools on Grayling farm	146 50	
		1,293 07
Botanical Department—Microscopes and sundry apparatus		510 20
Veterinary Department—Microscopes and sundry apparatus		628 83
Zoölogical Department—		
Microscope, balances and insect cases	$279 34	
Apiary, 85 colonies of bees, tools, etc.	649 35	
		928 69
		$12,733 40

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TABLE NO. 17.—*Income of the Agricultural College from all sources, from the date of its foundation to the present time.*

Year.	From State Legislature.			Interest from United States Land Grant.	Total.
	Appropriations for Current Expenses.	Appropriations for Special Purposes.	Land Sales, Salt Spring and Swamp Land Grants.		
1855			$56,320 00		$56,320 00
1856					
1857	$40,000 00				40,000 00
1858					
1859	37,500 00				37,500 00
1860					
1861	6,500 00		152 25		6,652 25
1862	10,000 00		218 97		10,218 97
1863	9,000 00		407 80		9,407 80
1864	9,000 00		726 09		9,726 09
1865	15,000 00		1,156 61		16,156 61
1866	15,000 00		1,094 27		16,094 27
1867	20,000 00		7,608 38		27,608 38
1868	20,000 00		592 49		20,592 49
1869	20,000 00	$30,000 00	17,559 00	$58 96	67,617 96
1870	20,000 00		1,320 02	2,720 93	24,040 95
1871	18,250 00	10,500 00	4,135 72	3,785 84	36,671 56
1872	18,250 00	3,000 00	217 05	7,175 65	28,642 70
1873	21,796 00	15,602 00	10 13	11,059 06	48,467 19
1874	13,000 00	15,602 00	150 13	14,061 98	42,814 11
1875	7,638 00	7,755 50	144 53	14,446 14	29,984 17
1876	7,638 00	6,755 50	1,773 09	16,830 17	32,996 76
1877	6,150 00	30,686 80	979 06	15,172 86	52,988 72
1878	6,150 00	5,686 80	826 60	15,807 09	28,470 49
1879	4,971 80	16,068 32	712 22	16,978 22	38,730 56
1880	4,971 80	7,068 32	797 55	17,837 24	30,674 91
1881	7,249 00	43,720 50	461 95	20,935 25	72,366 70
1882	7,249 00	8,945 50	358 46	22,507 45	39,060 41
1883	8,385 00	23,798 00	391 95	30,749 60	63,319 55
1884	8,385 00	10,526 00	1,259 90	27,909 72	48,080 62
1885		35,103 00	187 50	29,770 40	65,060 90
1886		22,617 00		30,461 04	53,078 04
1887		* 44,040 00	† 198 20	† 24,611 37	68,849 57
1888		30,782 50	444 20	§ 47,406 60	78,608 30
1889		* 20,973 00	10 50	§ 46,322 69	67,306 19
Total	$362,083 60	$389,195 74	$100,214 62	$416,608 26	$1,268,102 22

* Including appropriations for weather service.
† Oct. 1, 1886, to June 30, 1887, nine months.
§ Includes $15,000 received directly from U. S. Treasury on account of experiment station.

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A SUMMARY OF THE RESOURCES OF THE MICHIGAN AGRICULTURAL COLLEGE.

Farm, buildings and equipments, as per inventory on pp. 20–21	$448,080 12
Agricultural College trust fund, from sale of lands of United States grant	357,619 20
Balance due on purchase money " " " " "	97,016 87
119,585.86 acres @ $5 per acre yet unsold " " " "	597,929 30
800 acres @ $5 per acre yet unsold of swamp land grant	4,000 00
Total	$1,504,645 49

The 119,585.86 acres yet vacant of the U. S. land grant are given in detail as located in the different counties in table No. 16, page 19.

The 800 acres of swamp land is what still remains unsold of a grant from the State to the College of swamp lands located in the townships of Lansing and Meridian in Ingham county, and Bath and De Witt in Clinton county.

The present amount of the trust fund is taken from the last line (that for 1889) of the fifth column of table No. 11, page 17.

The balance due on purchase money is reported by the Commissioner of the State Land Office, and consists of the total amount for which the College lands have been sold up to the present time, *i. e.:*

The total of the tenth column in table No. 10, page 16	$499,122 12
Less the payments made on these sales, constituting the trust fund	357,619 20
	$141,502.92
And less balances unpaid on abandoned descriptions which have reverted to the State by forfeiture for non-payment of interest, as shown in column eleven of table No. 10 page 16	44,486 05
	$97,016 87

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DEPARTMENT REPORTS.

REPORT OF PRESIDENT CLUTE.

To the Hon. State Board of Agriculture:

I have the honor to submit a report of my first few months of service, and of the present condition of the college.

Monday morning, May 27, brought me to the college, after an agreeable, if somewhat wearisome, journey from south California. President Willits had left for his new post in April, and after his departure Dr. R. C. Kedzie had ably and faithfully served as President *pro tem.* From all members of the faculty and from the students there came to me friendly greeting. Since the days when I was a student and a professor here the college has developed much in many directions, which bring upon the executive officer a large amount of detail work. In getting the run of the work I have had the forbearance and assistance of all, for which they have my grateful acknowledgments.

The condition of the several departments, and the work done by them, are fully set forth in the reports of the heads of those departments, and need not be repeated. All the departments are in a flourishing condition, and the students attending them are contented and interested. The general deportment of the students has been most excellent. Inattention to duties has been but slight, and has usually been corrected by a friendly interview. A few cases of unmanly conduct have received severer treatment. As a rule the students coöperate faithfully with the faculty in the preservation of good order.

CHANGES IN THE FACULTY.

The acceptance by President Willits of the post of Assistant Secretary of Agriculture in Washington took from the college an executive officer who had served it with much ability and earnestness. It has been a pleasure to his successor to hear the many good words spoken about him by faculty and students, and to see on every hand witness of his good work.

The resignation of the Professor of Agriculture in July put on the Board the difficult task of finding another man for the chair. After much inquiry and correspondence the opinion was reached by every member of the Board that E. Davenport, a graduate of the college in the class of '78, who had a few months before returned to the college to pursue post graduate studies and as assistant to Dr. Beal, was excellently equipped for the place. He

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was chosen, entered upon duty Aug. 26, and the department is going forward harmoniously under his leadership.

The chair of English Literature became vacant at the end of the summer term by the resignation of Prof. E. J. MacEwan, whose work in his department had been highly appreciated by Board, faculty and students. The Board changed the chair to that of "English Literature and Modern Languages," and chose Prof. E. P. Anderson, M. A., Ph. D., to fill it. Dr. Anderson entered on duty August 26, and his good work is giving him a strong hold on the whole college. The able assistant in English, Prof. H. R. Pattengill, left also at the close of the summer term. His place was filled by the appointment of Prof. A. B. Noble, A. B., a graduate of the University of Iowa, who was warmly commended to the Board, and whose work is justifying the commendation. Mr. H. T. French, who had been for years the efficient assistant on the farm, resigned in mid-summer to accept a responsible post in the Oregon Experiment Station. His place has been filled by the appointment of E. A. Burnett, B. S., of the class of '87, whose known ability as an agriculturist and a student secured him the place. P. G. Holden, B. S., of the class of '89, was appointed assistant to the chair of agriculture in experiment work. The subjects included under the name "physics" have so important a place in the college studies that it was thought best to create a separate department for them. This was done at the August meeting of the Board, and Prof. P. B. Woodworth, B. S., who had been for two years teaching the topics here, was made assistant professor, and given charge of the department. His good work in the past is guarantee of good work to come.

The post of assistant to Dr. Beal became vacant when Prof. Davenport was made professor of agriculture. It was filled at the October meeting by the appointment of C. H. Wheeler, whose familiarity with the flora of Michigan and the west, and with systematic botany in general, fits him especially for the work that will come upon him. He enters upon duty February 25, 1890.

In July Mr. F. H. Hillman, B. S., assistant to Prof. Cook, and a graduate of this college in the class of '88, was appointed professor of entomology and botany in the University of Nevada. To fill his place, F. J. Niswander, B. S., of the class of '89, was chosen.

HORTICULTURAL LABORATORY.

The new Horticultural Laboratory, completed in March last, proves well adapted to the purposes for which it was built. Its pleasant rooms, light, airy, dry, are a great improvement over the basement in which it had been housed, as to office, tool-room, and work-room, for many years.

PROPAGATING HOUSE.

The new propagating house for this department is approaching completion, and promises to be satisfactory. It will be of great service to the professor in charge in teaching, and in the practical work of the gardens. It will be ready for use in the spring.

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AGRICULTURAL LABORATORY.

The many excellent buildings which from year to year have been built for the farm, and the large amount of material provided for farm work and illustration, have always shown the interest which the people of Michigan, the Board, and the Faculty have taken in this department.

The new Agricultural Laboratory is another and significant illustration of this. The building committee is watching the progress of the building with much interest. It is hoped that it will be ready for Prof. Davenport's class and laboratory work by the opening of the spring term. In the present agricultural class-room in College Hall the Agricultural Department has had one of the most convenient and accessible rooms belonging to the College. But the new quarters will be near the other farm buildings, and having been planned for this work, will have a completeness nowhere surpassed. It is most fortunate for the College that this new building adds so opportunely to the class-room accommodations. The fine room which has been used as an agricultural class-room can at once be made of much service by classes in another department, that have been getting along uncomplainingly with inferior accommodations.

SUMMER SCHOOL.

The valuable apparatus, laboratories, and library of the College, its able professors, and its healthy and beautiful location make it a desirable place for a "summer school" for the benefit of students who desire to give themselves better training in special studies. A number of graduates of other colleges, and teachers in the grammar schools and high schools of the State, summered with us this year. Their faithful devotion to their specialties kept them employed not less than ten hours a day at laboratory work. The progress they made by aid of our excellent apparatus in every department, and of the constant suggestions of enthusiastic professors, was to them and to us very satisfactory. They are most cordial in their expressions as to the pleasure and profit derived from their stay among us. We shall attempt to make the advantages we can offer for this summer work more widely known among the public school teachers of the State and shall probably welcome a larger number of them in the summer of '90. There is difficulty in providing rooms for these summer students. Next summer we shall probably advise them to bring with them such bedding as will enable them to "camp out" in the Drill Hall, which is a light, well ventilated, airy building, very pleasantly located. It will give good accommodations to a large number of gentlemen.

WINTER LABORATORY WORK.

There is a growing tendency for some laboratories to be kept open for the accommodation of special students during the long winter vacation. There could be no better time for work, if a student is in earnest and knows what he wants to do. The quiet of each returning day is uninterrupted. There is no delay in obtaining the use of apparatus and material, nor from recitations or other routine of College life. Investigations that require

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careful work day after day for weeks or months can be pursued with no break.

These advantages have for several winters attracted some students to the laboratories. The tendency seems to be infectious. Quite a class will remain the coming winter, who will give their time mainly to Agriculture, Horticulture, Botany, Entomology and Zoölogy. One of the enthusiastic professors recently said to me that indications pointed to a soon-coming time when his laboratory would be open for work ten hours a day for every working day of the year.

FAIR EXHIBITS.

At the State Fair in Lansing the College made a large and interesting exhibit which attracted much attention, and excited suprise. People who have not visited the College and have not noticed from year to year the reports as to its development, have very imperfect ideas as to its rapid growth and its present advanced condition. The superior vegetables in great variety; the fruit; the farm products; the stock; the tools, machines and steam engines made by the students in their regular shop-work; the beautiful display of hot-house plants; the few very attractive cases of insects that were shown from the McMillan collection, so rich in rare specimens; the suggestive exhibit of skeletons and models of animals from the Veterinary department; the singular appearance of the apparatus from the chemical and physical laboratory; and the instructive specimens from the botanical department drew a constant and curious crowd. As much of the College exhibit as could be easily and safely transported was exhibited at the Detroit Exposition. Here, too, it was examined and admired by very large numbers, who kept the attendants busy from morning until night. The authorities of the Exposition were most courteous in assigning space, and in affording facilities for our display. So also were the officers of the State Fair in Lansing, who did all that they were asked to do. By special request the exhibit of the Veterinary department was taken to the Grand Rapids Fair, where it had generous treatment from the managers and appreciation from the public. Much good could be done by College exhibits at many different fairs. But the labor, expense, absence of material from the lecture rooms, and absence of students and professors from college duties in order to care for the exhibits will probably preclude us from attempting to exhibit except at the State Fair and the Detroit Exposition. At the Exposition in Detroit the advantage of having the exhibits from all the departments of the College adjacent to each other was apparent. In this way the varied character and extent of our study and work are clearly shown, and the trouble of caring for the exhibit is much reduced. It is hoped that a similar arrangement can be made for the exhibit at the State Fair in future years.

THE M'MILLAN COLLECTIONS.

The College is greatly indebted to Senator James McMillan, of Detroit, for the most generous gift of a large collection of butterflies and of beetles. The butterflies include 8,000 species and 12,000 specimens. The beetles include 8,000 species and 40,000 specimens. This gift is more fully described in the report of Prof. Cook, through whose interest in his department the gift was inspired. It is hoped that this kindly act of Senator

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McMillan is but a forerunner of many other gifts from patriotic sons and daughters of Michigan, who would like to see her State agricultural school thoroughly equipped in every respect. Our College has now a valuable beginning in museum, cabinets and library. And yet those who use these most, that is the professors in different departments and the special students, find them by no means complete. We could use much fuller collections with great profit to our students and to the general public.

THE LIBRARY.

Perhaps the most pressing need at present is books for the library, in the departments of history, biography, travel, literature and philosophy. We need books in all these departments. Are there not wealthy men in Michigan who have made their wealth from the farms, the merchandise, the land, the lumber, the mines, the salt of the State, who will be glad to supply this need, as an exression to the whole people of their appreciation of the State that has dealt so well by them? The departments of agriculture, horticulture, stock breeding and general science are better supplied with books for present use, because a very large part of the money at the disposal of the College for the purchase of books has been used in these directions for thirty years. Yet here, also, we could use a large sum of money today.

INSTITUTES AND CONVENTIONS.

Our professors are in demand not only in the Institute work in our own State, but in agricultural, horticultural, chemical, botanical, and entomological meetings in other States and in national associations. The pressure by outside parties for them to go to such meetings is often very urgent. It is a good thing for the different lines of study and work for which our College stands, to have our men attend these important gatherings; and it is fortunate for the College to be represented by our able professors in such meetings; and it is helpful to the men themselves, and to the College, for they bring back the newest thought and the most improved methods as well as renewed enthusiasm in their work. Yet as a rule our professors have resolutely declined the many requests for their attendance, as their absence would often occur in term-time, and might interfere with College progress. In a few cases, by a careful planning of their work beforehand, they have been able to leave it in the hands of assistants for a few days, and go to meet their co-laborers from other States. Some members of the Board of Agriculture have attended at such meetings with profit to the meetings and with interest to themselves. It is to be hoped that in future professors and the members of the Board may both be able to go more frequently. Within poper limits such attendance can result only in good to our College and to the increasing circle of enthusiastic men who are now working in colleges in nearly every State, for the spirit and method in education wherein, more than thirty years ago, our College was a pioneer.

THE VETERINARY DEPARTMENT.

The great importance of the animal industry to Michigan, and to the whole west, suggests the need of further developing the college work in its interests. The necessity of attending with the greatest care to the breeding of domestic animals in order to promote their health is now acknowledged by

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all intelligent agriculturists. Healthy blood in sire and dam produces healthy offspring. Disease annually carries off large numbers of horses, cattle, sheep and swine. In cities, where large numbers of horses are kept, disease sometimes causes serious interruption to business; it is always present as a factor of evil in many large industries. These facts led the college some years ago to establish the Veterinary Department, and to give to all regular agricultural students such a course as conditions made possible in veterinary science. This has proven a popular and profitable course. The time has come when we should look towards its enlargement. We should so extend the veterinary course as to furnish a complete training that will fit the graduates of the course for the practice of veterinary medicine and surgery. As much of the training needed by veterinary students can be given in the regular college classes, as at present organized, the expense of developing the present veterinary department to a full veterinary school, whose degree of V. S. would rank as the equal or superior of any such degree in America, would not be large. One additional professor would do the work in teaching the special veterinary topics. The present veterinary building would answer the requirements for a few years. A hospital for diseased animals could be built for a few thousand. Two laborers to do the manual work of the hospital would at first suffice. The benefit to Michigan and the northwest in sending out every year a class of well-trained veterinarians would be out of all proportion to the moderate sum the department would cost. It seems to me that we should look seriously toward such development of our present efficient veterinary department at an early day, and I ask for it the careful consideration of the Board.

DEGREES CONFERRED.

At the commencement on Tuesday, August 20, a class of forty-three received the degree of B. S. Their names are as follows:

D. Anderson, Jr.,
R. S. Baker,
A. D. Baker,
B. K. Canfield,
G. L. Chase,
L. Churchill,
F. N. Clark,
R. J. Cleland,
Will Curtis,
L. A. Clinton,
W. E. Davis,
G. C. Davis,
J. W. Earle,
G. L. Flower,
D. A. Garfield,
E. A. Holden,
P. G. Holden,
O. C. Hollister,
G. J. Jenks,
W. Lightbody,
E. G. Lodeman,
A. L. Marhoff,
H. A. Martin,
T. F. McGrath,
Alex. Moore,
F. J. Niswander,
J. W. O'Bannon,
E. N. Pagelson,
F. M. Payne,
W. S. Palmer,
L. W. Rice,
W. E. Rohnert,
O. J. Root,
W. L. Rossman,
F. M. Seibert,
Mary Smith,
H. A. Stewart,
C. H. Todd,
J. W. Tourney,
W. H. Van Devort,
H. E. Weed,
A. G. Wilson,
R. H. Wilson.

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This is the largest class ever graduated by our College. Those professors who knew its students during their four years' course speak in strong praise of their ability and attention to duties.

On the same day the degree of M. S. was conferred on the following:

C. L. Crandall, for proficiency in Horticulture.

H. T. French, for proficiency in Agriculture.

C. E. Smith, for proficiency in English.

Fred. C. Miller, for proficiency in Building and Architecture.

At the opening of the present College year, August 26, there was an unusually large accession of students, so that the number in actual attendance and the enrollment for the term exceed those of any previous term. Considering the circumstances, this increased attendance is most encouraging. It shows that the College has become rooted in the esteem of a large number of people, who have confidence in its spirit, its methods, and its results in the training of students.

AGRICULTURAL COLLEGE, MICH., October 31, 1889. O. CLUTE.

REPORT OF THE PROFESSOR OF AGRICULTURE AND SUPERINTENDENT OF THE FARM.

To the President of the State Board of Agriculture:

DEAR SIR—The report herewith submitted of the work of the Agricultural Department embraces, in addition to the College year ending June 30, 1889, the month of July and to August 25, when * * * my official relations with this College terminated.

INSTRUCTION.

Six seniors, 43 sophomores and 60 freshmen have received instruction in this department during the year.

The topics discussed and the methods pursued during the year have not varied materially from those outlined in former reports. The practical topics which must always form the basis of any and all true courses of study in practical agriculture, the topics which have had a place in the curriculum of the College since its organization, and have been followed by every professor of agriculture the College has ever had, have not been changed or modified during my administration, except that in 1883 I secured a term of work in the sophomore year in which the subject of feeding animals was made prominent.

The sophomores in the fall had a half term in the study of the fall crops, and the characteristics of the different breeds of sheep, swine and horses.

They were interested and their examinations evidenced a good degree of attention to their work.

In the spring term the freshman class, numbering 60, took up the topics assigned in the agricultural course as catalogued for this term, viz: General principles of drainage, including the drainage of buildings and laying

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out and construction of farm drains, and breeds of cattle, their characteristics and adaptation to practical purposes.

Especial care was taken to give clear and definite instruction on these topics, and to enforce the same by practical illustrations.

The class studied good specimens of various breeds of cattle in the yard and scaled them point by point, and then by comparing two specimens of the same breeds were able to note for themselves how nearly they conformed to the standard of excellence, and by comparing one breed with another to note more clearly the differences between them. * * * *

LECTURES AND INSTITUTES.

I have delivered two lectures in the regular assignment of the College Wednesday afternoon lecture course on "The Educated Farmer, his Duty and Responsibility," and "The Manual Labor System of the Michigan Agricultural College."

I was assigned to the State institutes at Lake Odessa and Brooklyn. By special invitation I presented a paper on "Drainage" at the Clinton county Institute held at St. Johns, and at Bancroft, Shiawassee county, one on "Feeding Steers of Different Breeds," and at the meeting of the Kalamazoo Husbandman's Club held at Richland I presented the same topic; also before the Ingham County Grange. As President of the Michigan Shorthorn Breeders' Association I presented an address at the annual meeting held in December.

I also prepared and read a paper before the Michigan Swine Breeders' Association and took part in the meetings of the Merino Sheep Breeders and the Holstein Friesian Cattle Breeders.

The annual meetings of the various breeding organizations, now held in one week at the capital city, brings together a large number of our most prominent farmers and stockmen for counsel, and it has been an increasing pleasure to me, from year to year, to meet and coöperate with these gentlemen in their enterprises so far as I could. Their utterances of sympathy and confidence, in many cases of the warmest personal friendships, have been most pronounced and helpful to me in my work. I beg to assure them of my heartiest appreciation and that they will not be forgotten.

At the annual meeting of the Michigan Dairymen's Association I made a report for the committee appointed to visit the experiment stations (consisting of Hon. Henry Chamberlain and myself as a substitute for Hon. Geo. B. Horton, who could not go) on the dairy work of these stations, and also took part in the discussions.

By invitation of the committee and members of the Board of Agriculture in charge I delivered two lectures at Washington, Pa., in February on "Silos and Ensilage" and "The Feeding of Steers of Different Breeds."

By invitation of the President and Secretary I read a paper on "The Relation of Breed to Milk and Beef Production," before the annual meeting of the Holstein Friesian Association of America held in New York city in March last.

I was pleasantly received at all of these points by large and intelligent audiences of the best men and women interested in agricultural pursuits and had abundant evidence that my discussions of live, practical farm topics were not lacking in interest and profit to my hearers. * * *

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[The report on Experiment Station work and bulletins of the Farm Department which here followed has been omitted from this place and will be found in the Experiment Station report later on in this volume.—H. G. R., Sec'y.]

NO PUBLIC SALE IN 1889.

The public cattle sale was not held this year, the Board deeming it not advisable on account of the depression in prices and lack of demand for breeding stock.

We have made but few private sales and the receipts from this, the largest source of income from the farm, have been very small compared with former years. For this reason the total receipts of the department fall much below those of any former years of recent date.

DONATIONS.

The following donations have been received by the Farm Department during the year: One Holstein steer from Hon. M. L. Sweet, Grand Rapids; two varieties of seed potatoes from S. Frogner, Herman, Minn.; one barrel of Monroe seedling potatoes from International Seed Company, Rochester, N. Y.; package of Cleveland's Colossal Corn from A. B. Cleveland & Co., New York; one car extra early field corn, "Minnesota King," from Northrup, Braslaw & Goodwin, Minneapolis, Minn.; one-half bushel Texas Red Oats from A. P. Coddington, Tecumseh, Mich.; Black Barley from D. H. Talbot, Sioux City, Ia.; attachment to Aspinwall Potato Planter for planting ensilage corn, from Aspinwall Manufacturing Company, Three Rivers, Mich.

AGRICULTURAL LABORATORY.

In my last report I referred to the fact that the Farm Department was the only one that did not have a building especially arranged and equipped for its work and suggested that such a building should be the next for which legislative appropriation was asked.

In the fall of 1888 I was requested to draw a plan of such a building as I thought was needed. I made such plans and $8,000 was placed by the Board of Agriculture in the estimates submitted to the Legislature, a majority of the members voting therefor.

The following resolution indorsing this action of the Board was passed by the Michigan Short Horn Breeders' Association:

Resolved, That this association is of the opinion that the Agricultural Department of the State Agricultural College is at a disadvantage in carrying on the work assigned to it, owing to a lack of a proper building, and that it asks the Legislature of the State at its next session to appropriate the sum of at least $8,000 for the erection of such a building, thus placing it more on an equality with the other Departments of the College.

The following resolutions adopted by the executive committee of the State Agricultural Society state what other associations indorsed such action:

WHEREAS, Large appropriations have been made by former Legislatures of this State to provide ample accommodations for the Chemical, Botanical,

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Entomological, Veterinary, Mechanical and Horticultural Departments of the Michigan Agricultural College, aggregating many thousands of dollars for each of these departments, while the Agricultural Department, according to the Governor's recent message, has been allowed only the meagre sum of $400 for this purpose; and

WHEREAS, We believe that the Agricultural Department at an Agricultural College, in the very nature of things, should be kept fully abreast of all others in the equipment for work, that it may stand on an equal plane with them; and

WHEREAS, The State Board of Agriculture has placed in their bill of estimates, to present to the State Legislature now in session, the sum of $8,000 for an Agricultural Laboratory and equipment, which action has been indorsed by the State Grange at its recent session, by the Michigan Sheep Breeders' Association, the Holstein, Short Horn and Galloway Cattle Breeders' Associations at their recent annual meetings; and

WHEREAS, We believe this appropriation will greatly contribute to the efficiency of the Agricultural Department and is in accord with the advanced public sentiment of the leading agricultural organizations in this State; therefore be it

Resolved, That, as the executive committee of the State Agricultural Society, we hereby cordially indorse the action of the Board of Agriculture in asking for this appropriation, and we hereby most respectfully petition the Honorable, the Legislature of Michigan, now in session, to make such appropriation, feeling assured that the best interests of the College and of the State will be served by such action. And your petitioner will ever pray.

Resolved, That the secretary of this committee forward a copy of this preamble and resolution to the President of the Senate and the Speaker of the House of Representatives at Lansing, with the request that they be printed in the Legislative Journal, and referred to the proper committee.

To Hon. John Holbrook, chairman of the Senate committee on the Agricultural College, and H. R. Dewey, chairman of the House committee, as well as to Dr. Baker, chairman of the ways and means committee of the House, much credit is due as well as to the members of these respective committees for their patient attention to my plea of the needs of the Agricultural Department and for their hearty indorsement of this appropriation.

The plan of the building for which this $8,000 was asked is two stories high with cellars for the storage of potatoes and roots and furnace room. A class room with room in rear connected by folding doors where animals or heavy machinery could be brought before the class, a room for the storage of heavy seeds, two offices, a hall and laboratory with dark room for photographic work, on the first floor; museum, seedroom, two rooms for members of the board and hall, on the second floor. * * * *

PERMANENT IMPROVEMENTS.

In looking back over the ten years of my work at the College and comparing the farm and its equipments then with what we now have there are visible signs of improvement.

The old cattle sheds, dirty and inconvenient, were remodeled the first year. A new grain barn with basement and silo was built in 1881, a commodious

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tool house, in 1883, replaced the unsightly shed which only gave partial shelter to the farm implements. In 1885 the experimental barn arranged expressly for feeding cattle was erected. The water supply for the barns and fields has been arranged and laid. A new iron bridge over the Cedar river, with substantial stone abutments and good approaches, has taken the place of the old unsafe wooden structure. A large silo has been built contiguous to the cattle barn; and during the last year the sheep house has been arranged for experimental feeding, and the boiler house has received an addition to be used as a grinding room. A large amount of tile has been laid and a large acreage reclaimed. The fields have been cleared of stumps and stones and so enriched by barnyard manure and good cultivation, that their productiveness has steadily increased. In 1882 trees were planted on both sides of the farm lane. These have grown rapidly and are every year making the lane a more attractive drive. Through my efforts a new road from the main highway to Trowbridge station, the junction of the Detroit, Lansing and Northern Railway with the Chicago and Grand Trunk, has been opened so that we have direct access to the station.

Ten years ago the stock did not meet with the approval of the farmers or breeders—indeed it was the subject of constant and invidious criticism from all visitors. It has been improved by the careful weeding out of inferior specimens and the selection and purchase of only animals of real merit. The reports of the ten years will show that the sales of stock have amounted in the aggregate to a large sum; and in this way the College has contributed to the very important work of stock improvement in our State. The annual cattle sales of the last four years have proved an excellent way of disposing of our surplus, and have called the attention of the farmers to the College and its work.

The Short Horn herd is now in excellent condition for a breeding herd, and has so many animals of individual excellence and approved breeding as enables it to rank with the best herds of the State.

The arrangements for carrying on experimental work are quite complete, and in the special lines of feeding, which I have inaugurated, an extra good lot of heifers and steers of different breeds for dairy and beef tests have been procured. I think I am warranted in saying that the farm and its equipment are in almost perfect order.

With the erection of the farm laboratory and class-room the department will have such appliances as are needed for the best prosecution of its special work. * * * *

Mr. Hiram T. French, who has been my assistant since his graduation in '85, and who has had the student labor in charge for two years past and in part the supervision of crop experiments, received a call from the Oregon Experiment Station, at an advanced salary, in July, and resigned his position here to accept the same. Mr. French carries with him to his new field of labor my best wishes.

Alice A. Johnson, class of '84, has rendered me efficient service in the office of the Experiment Station in the tabulating and compiling of the bulletins issued and has relieved me almost entirely of the details of office work. * * * The steady employment of one qualified for the task has proved most satisfactory and the work done must be the best evidence of the value of the service rendered.

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Wm. Brown has continued in charge of the stock and rendered efficient aid in some of the feeding experiments.

Thos. Jack has had charge of the experimental steers and the sheep and has proved himself a skillful and reliable man for such work.

Henry Munn has been in charge of field work. Good crops utter the praise of his labors.

Whatever of success in the work of the year has been attained, is due in good part to the cheerful compliance with my wishes of these helpers. They have entered into my plans heartily and in carrying them out have given me intelligent and faithful coöperation.

In closing this final report as Professor of Practical Agriculture and Superintendent of the Farm, I desire to record my appreciation of the friendship and support of those members of the successive Boards of Agriculture, who have taken an earnest and sincere interest in the Farm Department.

When I came to the College, President T. C. Abbot was in charge and Hon. H. G. Wells was president of the Board. While neither of these gentlemen were practical farmers they were always ready to support any measure that promised to make the Farm Department more efficient. They were broad enough to know the needs of all departments of the College. * * * * Their advice, their hearty words of encouragement, their efforts to make me comfortable and "at home" in my new surroundings were most opportune and made doubly precious by the genial and gracious manner in which they were given. M. J. Gard, a man of opinions who had the courage of his convictions, J. Webster Childs, Geo. W. Phillips, all true and well known representative farmers, were associated with Judge Wells and yourself. Then came Wm. B. McCreery and T. D. Dewey who never swerved in their support of measures calculated to advance the practical departments of the College. Henry Chamberlain and E. W. Rising were appointed by Governor Begole. No truer, more candid and discreet men ever had a place in College councils. Their services illustrated the advantages of non-partisan Boards as securing stronger and more popular support to the institution. * *

Geo. B. Horton was the recent chairman of the farm committee. He was a man who sought information for himself and who had decided ideas about agriculture at Agricultural Colleges. Mr. Horton's resignation, after a year and a half of service, I greatly regretted. With you, Mr. President, as a member of the farm committee, my relations have been most intimate. For your kind, unwavering and intelligent support of the Farm Department I am greatly indebted. Your personal confidence and friendship has given real help and encouragement, amid the difficulties with which I have had to contend. The thoughts of these cordial relations with yourself and colleagues I shall cherish as my pleasantest memories of College life.

In this connection I should do injustice to my feelings, did I not refer in warmest terms of appreciation to the stanch and unswerving support of the Michigan Farmer. It has spoken with no uncertain sound in defense of the Agricultural Department and in behalf of agricultural interests. * *

CONCLUSION.

I have served the College ten of the best years of my life. I have not devoted a large share of my time to matters personal to myself but have given my efforts to the work for which I was employed. I do not remember to have

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asked for a single vacation, or to have had one during these years in which College work and duties did not occupy the major part of my thought and time. And while my duties have been increasing I have never complained of overwork.

I may be pardoned for saying that I believe that in no year of my connection with the College have my labors been more abundant, more appreciated by the farmer whose interests I have aimed especially to serve, more kindly commended by the agricultural press, more valuable to the students under my charge and to the College than the one covered by this report. * * *

I look back over the years and, while I am conscious of many errors of judgment and practice, I can say I have endeavored to be loyal and devoted in the varied relations I have sustained. I note with some satisfaction the improvements wrought, the advance made during my term. I shall remember the friendship and confidence of many of the students with whom I have been associated.

I am glad in my heart to be assured in no uncertain way that I retire with the confidence, the sympathy and good will of the farmers of Michigan.

Respectfully submitted,

SAMUEL JOHNSON.

LANSING, Oct. 10, 1889.

REPORT OF THE PROFESSOR OF HORTICULTURE AND LANDSCAPE GARDENING.

To the President:

I desire to present the following report of the work of the Horticultural Department for the past ten and one-half months, during which time it has been under my charge.

INSTRUCTION.

During the twelve weeks of the fall term instruction in Horticulture was given to forty students in the junior class. The time was spent in discussing the methods of plant propagation, fruit growing and kitchen and market gardening. The students were also required to write two essays upon topics relating to horticulture.

The first six weeks of the spring term were spent by twenty members of the senior class in an elective course consisting of (1) a hasty consideration of some of the principles of plant growth and their application to the work of the horticulturist, and (2) a few lectures upon some of the more common diseases of plants.

Twenty-five lectures on landscape gardening will be given to the members of the sophomore class during the last half of the summer term.

STUDENT LABOR.

During the year nearly all of the work of the garden and grounds has been performed by the students. The total number enrolled on the books

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of the department for manual labor, is one hundred and twenty-five, of whom fifteen have been seniors, thirty-five juniors, and seventy-five freshmen. The largest number enrolled at any one time was during the fall term, when eighty-five were recorded.

As the curriculum is now arranged the juniors are required to work in this department, and an attempt is made to so arrange the work for them, that they at some time during the year will perform all of the more important operations of horticulture, such as sowing seed, transplanting, grafting, budding, layering, making cuttings of various kinds, pruning, and preparing vegetables and fruits for market.

When not engaged in the so-called educational work they are used to superintend the work of the under classes, in experimental work, or in such other duties as they can perform to the best advantage.

The seniors, with whom the work is elective, are as far as is possible allowed to select their own line of labor, in the vegetable or fruit gardens, or on the grounds, as supervisors, or in taking notes upon the condition of the crops or trees.

To the freshmen falls most of the drudgery of the department, such as hoeing, ditching, weeding, and composting. Although much of the work has been far from inviting, it has been cheerfully performed. With few exceptions the attendance has been regular, and the students have taken hold of the work in a satisfactory manner.

The labor system in this department owes much of its success during the past year to the earnest support it has received from other members of the faculty. Individually and as a body, they have aided in placing the manual labor on the same plane as the class room exercises.

HORTICULTURAL LABORATORY.

The new laboratory was completed in November and was fitted up and furnished ready for occupancy at the opening of the spring term. It has proved well adapted to the work for which it was designed.

The class room is on the second floor, is well lighted and is provided with blackboards, and seats for seventy students. The specimen room adjoining is provided with three cases for specimens and apparatus for class room use, and space remains for three small wall cases to be added as needed. A beginning has been made upon a collection of the different kinds of fruit for purposes of study and comparison. We desire also a collection of vegetable seeds, and in addition to such varieties as we are able save ourselves, have been promised a complete collection by D. M. Ferry & Co. of Detroit.

One of the cases will be used for a collection of all the hand tools used by the horticulturist.

The laboratory room proper is provided with tables, cases, etc., and is occupied in the fall by the juniors and in the spring by the seniors who elect horticulture. The seed room is also on the second floor and is equipped with seed cases and tables.

The rooms on the first floor consist of the study or office of the department, with desks, bookcases, etc.; the tool room, in which are the racks and cases containing the tools used by the students in their manual labor; and the carpenter shop in which many simple appliances are made and the broken implements are repaired.

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The basement contains a room for winter grafting, one for the washing and preparing of vegetables for market, beside rooms for the storage of fruits, vegetables, cions and grafts, and fuel.

GROUNDS.

The proper care of the grounds requires the work of from ten to fifteen students (for the two or three hours per day that they work) during the school year. The past spring considerable extra work was performed in grading and turfing about the three new buildings, Abbot Hall, Howard Terrace and the Horticultural Laboratory. Walks and drives were laid out about them, and several hundred large evergreens were transplanted in groups or as screens.

There are now on the College grounds nearly six miles of walks and drives, and to trim the borders and rake them over every ten days or two weeks is no small task.

The lawns on Faculty Row and around the buildings have been cut regularly with horse or hand lawn mowers, and about twenty acres, including all the remaining land between the west entrance and the vegetable garden, were cut every two weeks with a one horse Buckeye mower.

In the spring some seventy-five new and promising varieties of shrubs and shade trees were purchased and planted on the grounds, to be used for purposes of illustration as well as to serve as ornaments.

GARDENS.

Although the vegetable and fruit gardens have been for the most part used for the work of the experiment station in testing varieties, methods, etc., we have engaged to some extent in commercial fruit and vegetable growing, in order that the students may acquire a practical knowledge of the methods used in the production and marketing of the different crops. The products have for the most part been sold to the students' boarding clubs or to the faculty at wholesale rates, and although the entire work of planting, cultivating, gathering and marketing has been done by students, most of whom had had no previous experience, they will compare favorably with those of the best commercial gardens. During the past year the sales have averaged about one hundred dollars per month, and from present appearances the income for the coming year will be at least two thousand dollars.

The small fruits passed the winter with little or no injury, and with the exception of the strawberries, which were injured by the late spring frosts, are giving full crops.

ORCHARDS.

The pear orchard is in excellent condition and has set a full crop of fruit. The old cherry orchard is hanging full of fruit of varieties belonging to the Duke and Morello classes. The sweet cherries have nearly all been killed out by the severe winters, in part owing no doubt to the fact that the soil is a stiff clay and poorly adapted to them.

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The renovation of the apple orchard undertaken four years ago by Prof. Bailey has been a complete success. In 1887 less than two hundred trees produced three thousand bushels of fruit. Last year a small crop was obtained and in spite of the drouth the trees made a fair growth. This spring all the trees blossomed and have set a full crop. With a favorable season many of the trees will produce from six to ten barrels of marketable apples.

Four years ago the orchard had a sickly appearance, the trees were full of dead branches, the leaves were of an unhealthy yellow color, and the trunks and branches were covered with moss. The foliage now is a dark, healthy green, and the branches are clean and smooth—a transformation brought about by good care and cultivation and without the use of manure or fertilizers. This spring the trees were sprayed soon after the blossoms dropped, with a solution of one pound of London purple in two hundred gallons of water, and no wormy apples have yet been noticed.

The orchard is now over thirty years old, and with the exception of a low spot in the center where tender varieties have been killed out, it will not suffer by comparison with any orchard of its age in the State.

My first year has passed with little or no friction, and profiting by the season's experience, and with increased facilities for work, better results can be hoped for in the future.

With loyalty to yourself and the best interests of the College, this report is respectfully submitted.

AGRICULTURAL COLLEGE, June 30, 1889. L. R. TAFT.

REPORT OF THE CHEMICAL DEPARTMENT.

President Clute:

SIR—I herewith present my report of the Chemical Department for the College year. The year has been one of steady and satisfactory progress The students have been faithful in their class work and have showed enthusiasm in their laboratory drill. The principle upon which the Chemical Laboratory is conducted, viz., that each instrument or piece of apparatus in the laboratory is for actual use, not only by the teacher but also by the student when once he is fitted for its use and can be profited thereby, naturally tends to awaken enthusiasm in any study thus pursued. To hear, to see and to do is a threefold cord to bind one to study. Distant be the day when there is anything at the Agricultural College too good for the student's use, if he is prepared to properly handle it and it is necessary for his best training. The instrument that is only fit to be kept under lock and key has no place in an Agricultural College. This does not imply that students are to have free range at all times of the College apparatus, irrespective of their preparation to use such material with profit. The great body of new students are without this preparatory training and could not use costly apparatus with benefit to themselves and without loss to the College. They should receive the training and then be allowed the use of instrumental aids in their work.

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The objection that such a system of laboratory training as a prominent feature in education involves a large amount of work for the teacher, has little force in any live and wide-awake college. "Prophesy unto us smooth things," is not the way to excellence, either in moral or in intellectual growth.

For the ancient Greek "I have seen" was the equivalent of "I know." In modern science "I have done" seems the necessary condition of full-orbed knowledge, and hence the imperative demand for a wider field for laboratory work. The large Chemical Laboratory with its abundant equipment affords ample scope for this training. A number of post graduates and teachers in the State have availed themselves of these opportunities.

OUTSIDE WORK.

Many subjects of inquiry come to the Chemical Laboratory for investigation and determination. The commissioner of railroads desired a test made of the quality of oil used in passenger cars in this State, because the ordinary testing apparatus of oil inspectors is of too limited range of temperature. A committee of the Legislature wanted information in regard to the composition and testing of cider vinegar; another committee, information in regard to what should be the legal standard for whole milk and for skimmed milk, etc.

Many letters have been received asking for information about marl and its uses, the marl beds of the State, etc. Numerous letters about the management of muck beds and reclaimed swamps, the manures to be used, the kind of crops to cultivate, etc. Others desire information about the value of certain grasses and forage crops for stock feeding, the relative value of certain mill products and waste grains.

These inquiries always require much time and investigation, and often a large amount of analytical work, but the results are so important to the parties inquiring that the work is cheerfully done. The College is thus a help to individuals as well as communities.

FARMERS' INSTITUTE.

I attended the farmers' institute at Grayling and presented a paper on the results reached at the Experimental Farm on the jack pine lands. This is a subject of deep interest to all our northern counties, and is watched by all in the vicinity. The subject will be more extensively considered in the report of the Experiment Station.

SOCIETY FOR PROMOTION OF AGRICULTURAL SCIENCE.

This society held its annual meeting for 1888 in Cleveland. I attended the meeting and gave the address, as president of the society; also a paper on the Relations of Tile Draining to Flood and Drought, which has been copied into a number of agricultural papers.

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INTERNATIONAL CONGRESS OF MEDICAL JURISPRUDENCE.

As delegate from the American Academy of Medicine, I attended the International Congress of Medical Jurisprudence in New York in June, 1889. The papers and discussions, while not relating to the ordinary pursuits of life, were of great value as related to human society and public welfare. I was appointed one of the vice presidents of the congress.

During the interregnum between the resignation of President Willits and your assuming the office of president of the college, additional labor and responsibility were thrown upon me as director *pro tem.* of the Experiment Station, and the local discharge of duties as President *pro tem.* during the absence of Acting President Wells.

By your appointment I was happily relieved of duty in both these offices.

Respectfully submitted,

R. C. KEDZIE,
Prof. Chemistry.

AGRICULTURAL COLLEGE, MICH., June 30, 1889.

REPORT OF THE PROFESSOR OF ZOOLOGY AND ENTOMOLOGY.

President O. Clute:

I submit the following report for the Department of Zoölogy for the past College year. It gives me great pleasure to report excellent work both in class room and laboratory. The students have been earnest and faithful to a marked degree. The work has been much as in previous years; and the classes have been large and enthusiastic. I wish to express my grateful acknowledgments of the valuable services rendered by my assistants Messrs. F. H. Hillman and A. B. Cordley, both of whom have conducted laboratory classes with exceptional success. Mr. Hillman left me during the year, having been called to the Nevada State University, as Professor of Entomology.

THE MC MILLAN COLLECTION.

In my last year's report, I made the following statement: "The one need of the department of instruction, is an enlarged museum and more extensive cabinets." It gives me exceeding pleasure to state that this need has been met in large part through the most generous gifts of Senator James McMillan. Through his noble benefaction, our cabinets are enriched by the Tepper Collection of Lepidoptera, and the Austin Collection of Coleoptera, which adds some 10,000 species, and 50,000 specimens to our entomological cabinets, and gives us one of the finest collections in the west. That the admirable opportunities for special work in the department are not unappreciated is evinced in the fact that six persons have already signified their desire to work in the laboratory during our next winter vacation. We now have very excellent facilities for special study in Entomology, which we hope to extend, so that very soon there will be no better in the United States.

The apiary and experimental work has been turned over to the Experi-

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ment Station, and so the work in these departments, which has previously been reported in this place, will now appear in the report of the Station.

OUTSIDE WORK.

During the past year, I not only attended and addressed two of the Farmers' Institutes in our State, but also the Shiawassee County Stock Breeders' Association of which I was President and the State Horticultural Society at its February meeting. I was also engaged to lecture before the annual meeting of the New York State Agricultural Society, and three other Institutes of that State. I attended and lectured before the North American Bee Keepers' Association at the annual meeting held at Columbus, Ohio. In February I was induced by special request to publish my experience and views on the "Silo and Silage." I published an edition of 3,000 copies, 2,600 of which were sold in less than four months. I spent much of the winter vacation re-writing, enlarging and revising my "Injurious Insects" which I hope to publish within the next year.

DONATIONS TO THE ZOÖLOGICAL DEPARTMENT.

Senator James McMillan, Detroit: 12,000 specimens Lepidoptera; 40,000 specimens Coleoptera.
O. S. Compton, Glenwood, Mich.: Fruit honey.
Sam'l Heath, Armstrong, Pa.: Clover honey.
Chas. Lewis, Middleton, Conn: Clover honey.
Ronald McDonald, Cheboygan, Mich.:

Hornblendic Quartzite.	Actinolite.
Hornblende.	Rough garnet.

S. D. Perkins, Farragut, Iowa: Smart-weed honey.
A. Wilcox, Manston, Wis.: Oak gall honey.
S. I. Freeborn, Ithaca, Wis.: Horse mint honey.
S. Coulthard, Southern Ohio: Clover honey.
H. R. Pattengill, Lansing, Mich.: Copper ore.
J. Y. Detwiler, New Smyrna, Fl.: Mangrove honey.
L. H. Dewey, Ag. Coll., Mich.: Milk snake.
Townsend North, Vassar, Mich.: Striped wool.
J. A. White, Hancock, Mich.: Mass copper.
J. L. Clark, Apalachicola, Fl.: Sour gum honey; silk from bee moth larva.
Astronomical Dept.: Meteorite from Transylvania; meteoric iron, Mexico.
W. J. Beal, Ag. College: Black and Yellow Warbler.
C. B. Cook, Ag. College, Mich.:

Brown Creeper.	Pine Warbler.
Black Snow Bird.	Golden Crested Kinglet.
Red Bellied Nut Hatch.	Brotherly Love Grunlet.
White Bellied Nut Hatch.	Yellow Throated Grunlet.
Chickadee.	Black Billed Cuckoo.
American Red Start.	Scarlet Tanager.
White Throated Sparrow.	Ruffed Grouse.
Red Breasted Thrush.	3 Spec. Musquash.
Shore Lark.	Common Mole.
Tit Lark.	

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Prof. H. Osborn, Ames, Iowa:

Pouched gopher.
Prairie dog.
Striped squirrel.

Willie Hiscock, Agricultural College: Raccoon.
A. I. Root, Medina, Ohio: Burma honey; boring by teredo.
A. C. Tyrrel, Madison, Neb.: Melissa honey.
Wm. Wrigglesworth, Crawford, Texas: Broom weed honey; milk weed honey
Henry Taufer, Salt Lake City, Utah: Pure sand from lake.
S. P. Homilton, Savannah, Ga.: 4 snail shells.
Whitney Watkins, Manchester, Mich.: Turtle.
J. A. White, Hancock, Mich.: Native copper; drill core.

Mrs. A. F. Hinman:

Hydroid coral.
Sea weed bearing coral.
2 Sea urchins.
5 Marine shells.
Shark's egg.
Clam shell.
2 Quartz crystals.
Infusorial earth.
Stinging barb.
10 Specimens mica.
Star mica.
Biolite.

F. M. Paine, Rockford, Mich.: 3 specimens Lepidodendra.
L. Churchill, Three Oaks, Mich.: 2 specimens Lepidodendra.

H. E. Weed, Lansing, Mich.:

Cast skin of snake.
2 Spirifers.
Fossil coral.
Agate.

Class '89:

Lepidodendra.
Fossil stem.
Ripple marks.

J. R. Atchley, Arlington, Texas: Centipede; Copperhead snake.

F. J. Niswander, Brimfield, Indiana:

3 Agates.
18 Arrow heads—Chert.
15 Cyathylloid coral.
21 Favosite coral.
10 Crinoids.
4 Fossil sponges.
9 Fossil brachiopods.
6 Quartz.
50 Fossil shells.
Bog iron ore.
54 Fossil coral.
Pumice stone.
Snail shell.
Lime stone.
Trap.
Marble.
Tin ore.
Vegetable ivory.
Gypsum.
Chert.

Frank H. Hall, Tecumseh, Mich.: Fossil coral.
Wm. H. Byerly, Owosso, Mich.: Travertine.
W. E. Meserve, Pomona, Cal.: Mica and quartz.
Gerard & Buchanan, Brackett, Texas: Datames.
W. H. Smith, Cosumnes, Cal.: 8 California mole crickets.

AGRICULTURAL COLLEGE, MICH., June 30, 1889.

A. J. COOK.

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REPORT OF THE PROFESSOR OF BOTANY AND FORESTRY.

To Oscar Clute, M. S., President of the State Agricultural College:

The following in brief is my report for the year closing June 30, 1889:

During the year for a half term or more, one hundred and forty-four persons have received instruction in structural botany, forty-eight in systematic botany, forty in physiological botany, sixteen in the use of the microscope as applied to the structure of timber, twenty-five in forestry, twenty-two in the examination of fungi and other lower forms of plant life, sixty-two have been instructed for one-fifth of one term in the study of the most important natural orders of plants. There have been seven special students, most of whom are graduates of this or some other college or normal school. Three of these received instruction during the long winter vacation. To accommodate so many students, during one term two classes were working at the same time in different rooms. Owing to so many conflicting interests, it has sometimes been found necessary to keep the laboratory open with one or more teachers present for ten hours a day.

The botanic garden has been kept in about its usual condition.

The museum has been increased by 323 specimens, besides many others which have been temporarily placed in a store room awaiting time to fully prepare and label them.

THE HERBARIUM.

To the average farmer an herbarium would be of little value, but to the botanist working in the interest of the agriculturist a collection of specimens, dried, mounted and classified, is of inestimable value. It is for him a chief instrument for work as is the plow or the harrow to the farmer. The botanist does much of his work in the winter season, when nature is resting and plants cannot be obtained for study. Comparatively few of the specimens needed for study can be found growing in any one place, nor can they all be made to grow well in one locality, even if transplanted. A classified collection of authentic specimens is valuable and sometimes quite necessary to aid in identifying specimens sent for name and information. Besides these very practical reasons for collecting an herbarium, there is the broader argument that in no way is intellectual advancement promoted more than by the study of nature in all her various phases, and a large herbarium spreads a wonderful and interesting chapter of nature's history before the inquiring student. For these and many other reasons a good working herbarium is a necessary fixture in a well equipped botanical laboratory.

As the Michigan Agricultural College possesses one of the finest botanical laboratories on the American continent, so it also possesses one of the largest and best collections of plants to be found west of the Alleghanies. All classes and kinds of plant life are represented except Algæ.

The specimens have been collected from all parts of the United States, Mexico, South America, Europe and a few from Asia. Altogether they make up a grand total of 19,781 specimens, representing about 10,000 species.

These are comprised in four collections; (1) the general collection, including all classes of plants from all localities; (2) the local collection, including specimens collected in Ingham county; (3) Ellis and Everhart's

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fungi, published exsiccati; (4) and duplicate specimens not mounted but classified and arranged for study.

The general collection includes specimens arranged as follows:

Phænogams (besides grasses) mounted	6,974
" " " not mounted	1,343
Grasses mounted	2,748
Cryptogams mounted	738
" not mounted	568
Total in general collection	12,371

The nucleus of the general collection was formed some years ago by the donation to the college of the Cooley collection by the heirs of the late Dr. D. Cooly of Washington, Macomb county, Mich. In 1884 about four thousand European specimens, obtained from the Kew Gardens, England, were added. Specimens collected from various sources and especially those from different parts of Michigan have been constantly increasing the members. Purchases have been made from the collections of Howell on the Pacific coast, Anderson in the Rocky mountains, Palmer in Mexico and Central America, and Pringle in the eastern United States and Mexico. About three hundred specimens have been obtained from O. A. Farwell of Keweenaw county, Mich., in return for identifying specimens for him. About four hundred specimens collected by the botanical expedition across the State in June of 1888 were added to the general collection. Numerous specimens of grasses have been obtained from the department of Agriculture at Washington.

Dr. Beal's private collection was added to the general college collection in the spring of 1889. This can be best described in his own words as given in his statement to the Board of Agriculture.

"When I came to this college, I brought with me a collection of herbarium specimens of about 2,000 species of plants, most of which are still unmounted, and not in condition to be easily studied. The collection consists of plants collected by myself in Maine, Massachusetts, Cayuga county, New York, Lenawee county Michigan, and Chicago and vicinity, Illinois; also of plants given me by Dr. Asa Gray, collected in the Rocky mountains, Buffalo, New York, also European plants collected by E. Cosson of France.

They are mainly flowering plants, ferns and their allies with some algæ and fungi. They are nearly all accurately labeled by experts or my own labels were approved by Dr. Gray. There are many cultivated plants; a collection of willows named by Anderson, a high authority; a fine lot of sedges, named by Boot, Cary and Dewey.

A number of these specimens are not in the College herbarium, and nearly all are from different localities than those in the college collection. At a low estimate these are worth on the market eight cents each, making a total of $160. This collection I will give to the State Board of Agriculture, provided they will allow me from time to time to have them properly mounted and placed in the College herbarium."

Nearly half of this valuable addition has already been mounted and placed in the herbarium.

It will be noticed by the figures given above that especial attention has been given to grasses. The collection in this order is probably not excelled by more than four others on this continent.

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All specimens placed in the herbarium are poisoned before being mounted to preserve from insect injury. They are mounted on standard size species sheets, and are filed away in genus covers in the order of Bentham and Hooker's genera, and in large genera the species are arranged in alphabetical order so that each specimen is readily accessible.

The local collection has grown by annual additions from plants growing chiefly near the College, and is designed partly for use by the students who may desire to compare with authentic specimens any plant they may collect. This collection includes about three hundred specimens of the various varieties of apple and pear blossoms.

The Ellis and Everhart collection of fungi include 2,300 species of typical and reliable specimens. Something of the kind is quite indispensable to the student of fungi.

In the duplicate collection there are 1,500 specimens of phænogams exclusive of grasses, 175 species and varieties of grasses, 30 species of ferns, and more than 50 species of fungi, all averaging at least eight specimens each, making a total of about 3,490 specimens.

Thus the grand total foots up as follows:

General collection	12,371
Local collection	1,820
Ellis & Everhart's fungi	2,300
Duplicate collection	3,490
Grand total number of specimens	19,781

I have spent some time in completing the volume of the first report of the State Forestry Commission. It has taken between three and four weeks to visit the five experiment stations three times during the past year; over one week to attend the Society for the Promotion of Agricultural Science and the American Association for the Advancement of Science held during our summer vacation at Cleveland, Ohio; another week to represent the Experiment Station at a meeting held in Knoxville, Tennessee, and over another week in attending a number of Farmers' Institutes.

I have also taken part in two meetings of the State Horticultural Society, lectured several times at meetings of the county grange and county horticultural societies. I attended, as usual, the meeting of the State Teachers' Association and the meeting of the State Grange. For nearly all of the above meetings papers were especially prepared. In no case was anything received in compensation for the service, save traveling expenses at a part of the meetings.

To visit one or more other States and lecture for pay has been declined for the past three years in succession.

I devoted every spare moment possible during the winter vacation to the preparation of my second volume of *Grasses*.

DONATIONS.

From W. Green, Au Sable, Mich.:

One bear tree.

From L. Hart, Tuscola, Mich.:

Loan of a wolf trap and piece of tree.

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From Hon. H. G. Reynolds. Agricultural College, Mich.:
Bark and leaves of *Sequoia gigantea*, three photographs of these trees.
From L. W. Watkins, Manchester, Mich.:
Sprouts from Mangrove, Sea-beans from Florida.
From R. H. Hollister, Baldwin, Mich.:
Natural graft of white pine.
From the U. S. Dept. of Agriculture:
Nine packages seeds, 136 species of plants collected in Lower California by Dr. Palmer.
From W. Petrie, class '90:
Hickory tree entwined by bittersweet.
From Charles Hoyt:
Piece of red cedar excavated by ants.
O. W. Crawford, Wolverine, Mich.:
Specimens of bird's eye maple.
From Ossian Simons, Graceland Cemetery, Chicago, Ill.:
Thirteen photographs showing views of the cemetery.
From Rev. J. Kost, Lake City, Florida:
A large box of specimens of trees from Florida.
From D. Olds, Vanderbilt, Mich.:
Specimens of barrel staves.
From John Berry, Vanderbilt, Mich.:
Cedar knot resembling snakes.
From C. F. Wheeler, Hubbardston, Mich.:
Seeds of five species of grasses.
From Experiment Station, Ames, Iowa:

Seeds of native grasses in varying amounts from 2 quarts to half a bushel:

Agropyrum glaucum.
Agropyrum tenerum.
Agropyrum unilaterale.
Andropogon provincialis.
Andropogon scoparius.
Cinna arundinacea.
Beckmannia erucæformis.
Boutetoua hirsuta.
Boutetoua racemosa.
Chrysopogon nutans.
Deyeuxia Canadensis.
Elymus Canadensis.
Elymus Virginicus.
Festuca tenella.
Glyceria arundinacea.
Hordeum jubatum.
Koeleria cristata.
Panicum virgatum.
Poa nemoralis.
Spartina cynosuroides.
Sporobolus heterolepis.
Stipa spartea.

From Botanic Garden of Dr. Alexander Batalin, St. Petersburg, Russia:

Seeds by mail as follows:

Avena nuda.
Bromus inermis.
Capparis herbacea.
Cenchrus catharticus.
Cenchrus montanus.
Eleusine flagallifera.
Eleusine scindica.
Elionurus hirsutus.
Eragrostis viscosa.
Iseilema laxum.
Linum usitatissimum.
Molinia cœrulia.
Onobrychis sativa.
Panicum miliaceum.
Pennisetum cenchroides.
Phleum pratense.
Raphanus sativus.
Soja hispida.
Sporobolus pallidus.
Trifolum repens.

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From the U. S. Department of Agriculture:

Seeds of the following, mostly collected in India:

Andropogon annulatus.
Anthistiria polystachya.
Aristida depressa.
Cenchrus catharticus.
Chloris barbata.
Chrysopogon serrulatus.
Eleusine flagellifera.
Eleusine scindica.
Elionurus hirsutus.
Eragrostis plumosa.
Eragrostis unioloides.
Eragrostis rachitrisa.
Festuca ovina, from Colorado.
Panicum circinatum.
Poa pratensis, from Lower California.
Polinia Japonica.
Tragus racemosus.
Uniola Palmeri, from Lower California.

From Dr. W. J. Beal, Agricultural College, Mich.:

Two thousand species of dried plants for the herbarium.

I am under obligation to my assistant, L. H. Dewey, for much work done in improving the herbarium and in preparing that part of the report referring thereto. To my assistant, C. B. Waldron, I am indebted for valuable services in the museum, and to both of these gentlemen for much other aid in teaching. I am yours sincerely,

W. J. BEAL,
Professor of Botany and Forestry.

AGRICULTURAL COLLEGE, MICH., June 30, 1889.

REPORT OF THE DEPARTMENT OF MATHEMATICS AND ENGINEERING.

President Oscar Clute:

I have the honor to submit the following report for the Department of Mathematics and Engineering for the school year of 1888 and 1889:

The resignation of Prof. L. G. Carpenter to take the chair of Engineering in the Colorado Agricultural College, and of Assistant J. B. Cotton to enter on the practice of law at Duluth, Minn., made it necessary to re-organize the department to some extent. Mr. Frank Hall and Mr. Henry Thurtell, both graduates of the class of 1888, were engaged as assistants in the department, and entered upon duty with the beginning of the fall term of 1888. Both these young men have succeeded nicely in the work for which they were engaged, and have been useful and valuable assistants. Mr. Hall taught the following classes: Fall term, freshmen algebra, three hours per day. Spring term, freshmen geometry, three hours per day, besides assisting in field work in surveying; summer term, freshmen geometry, three hours per day, assisted in laboratory of strength of materials.

Mr. Thurtell taught classes as follows:

Fall term, 1888—Sophomore algebra, three hours per day.

Spring term, 1889—Trigonometry, one and one-half hours per day; field work in surveying, two hours per day.

Summer term, 1889—Analytical geometry, one hour per day; assisted in astronomy two hours per day.

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Lieut. W. L. Simpson taught trigonometry, fall term, 1888.

I have taught the following classes:

Fall term, 1888—Agricultural engineering and lithology, differential calculus, trigonometry.

Spring term, 1889—Surveying, three hours per day; integral calculus.

Summer term, 1889—Strength of materials; astronomy, two hours per day.

The classes have been on the whole well filled with attentive and well-prepared students, so that while the year has been a busy one, it has also been a pleasant one.

STEAM HEATING PLANT.

Little has been done to this plant except to keep it in repair and to improve its efficiency wherever it had been found defective.

Mr. James Wiseman, foreman of the iron shops, who has been the efficient engineer for the past four years, was obliged to give up his oversight of the steam works, because of the necessity of giving his full time to the iron shop. Mr. Richard Hiscock was appointed to take charge of the steam works. This he has done very efficiently.

The steam heating plant is in better condition than ever before, and less and less complaint is heard of poorly heated rooms each year. It has been the policy for the past two or three years to re-pipe each room having a defective heating apparatus as soon as possible after learning its condition. I had all the exposed steam pipes covered with a layer of asbestos paper, a covering of brown paper, and a thick coating of hair felt; the whole was then covered with canvas, sewed in place. The result will be a material reduction in our coal bill.

HOT WATER HEATING PLANT.

The new dormitory, Abbot Hall, was fitted with a hot water heating plant, consisting of a Bolton boiler of three fire pots, and a box coil, with a heating surface of about 1 to 50 cubic feet in each room on the second floor, and 1 to 40 cubic feet in each room on the first floor. The work was done by contract by F. C. Bennett & Co., of Lansing, for $1,300, and has proved in all respects a success. We covered all the main circulating pipes, as described for steam, during the spring term.

We have built, and have nearly in place a hot water heater, for the secretary's office, to be used during the winter vacation, at which time steam can not be had. We shall also build and put in place a complete plant for heating the new agricultural building during the coming winter.

BATH HOUSE.

We have equipped a bath house with ten tubs for the use of the students. The building was heated, supplied with hot and cold water, and the bath tubs set complete by our own men. The job, though a very complicated one, was thoroughly done, and worked perfectly without any remodeling from the first. The estimated cost of the bath house and equipments was $600, of which the students raised $300 as a loan, and the Board appropriated

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the same amount. The building was erected by contract by Elias Sprosa for $385. The bath tubs and equipment cost about $150; the labor of erection about $60. The water for the bath house is heated by steam in a tank erected several years ago over the boilers, and seems to be all that could be desired.

Various other constructions of small moment have from time to time been in my charge, regarding which detailed report has already been made to the board.

During the winter vacation I visited Memphis, Tenn., and delivered an address, as per invitation of the National Society of Brick Makers. I returned by the Mississippi river.

I prepared an article on "Road Making," which was read at the Farmers' Institutes at Flint, Big Rapids and Brooklyn. It was also published in the Michigan Farmer and in the Drainage Journal of Indianapolis.

I am respectfully yours,

R. C. CARPENTER,

Professor of Mathematics and Engineering.

AGRICULTURAL COLLEGE, MICH., October 1, 1889.

REPORT OF THE VETERINARY DEPARTMENT.

To the President of the Michigan Agricultural College:

SIR — Having the honor to report the work done in the Veterinary Department of this College during the year 1888–9, I beg leave to submit the following:

During the fall term my class consisted of thirty-four students, being thirty from the senior class and four specials, and to it daily lectures were given upon the subject of the anatomy of farm animals. The discussion of the subject was aided by diagrams, skeletons and the models of many parts of the horse and other domestic animals. After the anatomy had been gone through in the class-room, a number of horses were purchased and dissected by the students themselves, who, I am glad to be able to say, manifested much interest in the work; and when certain anatomical divisions of the cadaver were dissected, drawings were made of it in order to still further impress the peculiar arrangements of parts upon the mind. These drawings have been preserved, as I think they reflect much credit upon the class.

During the latter part of this term I was materially assisted in the practical part of the work by Mr. N. S. Mayo, who acted as demonstrator of anatomy to one half of the class while I took the other.

The spring term was devoted largely to a description of the most important diseases of our domestic animals, which were illustrated in some instances by the existing disease in the living animal, in others by pathological specimens, and in still others by diagrams and models. In order that the student might get as much practical work as possible in this department, one day a week was devoted to the performance of operations, and also the manipulations of living creatures, in order to show how to apply the various remedial agents, etc., in case of sickness or accident.

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The summer term could scarcely be looked upon as anything more than a continuation of the spring term, for the same general plan of work was adopted.

During these two terms I received very valuable help from Assistant Mayo in giving instruction in the practical part of our work. I am glad to be able to say at this time that our museum still continues to grow, which keeps the aids in teaching ever on the increase.

Besides my regular class work I delivered an afternoon lecture in the chapel, issued the required bulletins from the department, and attended to the medical requirements of the live stock in the Agricultural and Horticultural departments. During the winter, or through our long vacation, I devoted much time to the study of micro-organisms.

As veterinarian to the Michigan Experiment Station I have been engaged in experimental work with a disease that often attacks cattle under the conventional name of "lumpy jaw."

As State Veterinarian I have visited many counties of Michigan and attended to much correspondence in connection with that office. I have also delivered addresses at our Farmers' Institutes, and before live stock associations of various kinds.

In closing this brief report I desire to express a feeling of much gratitude for the courteous treatment I have received from all hands during my operations in all capacities.

I am, sir,

Yours respectfully,

E. A. A. GRANGE,

Prof. of Veterinary Science.

AGRICULTURAL COLLEGE,
June 30, 1889.

REPORT OF THE MECHANICAL DEPARTMENT.

To the President of the Michigan Agricultural College:

SIR—I have the honor to submit herewith my annual report of the work of the Mechanical Department for the past year.

My personal work has been as follows:

In the fall term—Senior analytical mechanics and elements of mechanism; junior agricultural mechanics, one half term and sophomore mechanical physics, one-half term.

In the spring term—Senior elements of mechanism and heat, one-half term each; senior machine design and junior analytical mechanics.

In the summer term—Senior electricity and magnetism, thermodynamics and steam engine, and junior analytical mechanics.

During the entire year Prof. Holdsworth has taught the mechanical drawing, with the exception of the sophomores and juniors in the spring term, when he was occupied with the free hand drawing for the agricultural freshman. We were fortunately able to obtain the services of Lieut. Simpson during this term, who took the two classes in drawing mentioned above, and also the mechanical sophomore mechanics.

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Prof. Woodworth taught the freshmen mechanical physics in the spring and summer terms, the sophomore agricultural mechanics in the summer term, and divided with me the work of the fall term junior agricultural mechanics.

The class-room attendance throughout the year has been excellent, and the zeal and interest shown are highly gratifying.

SHOPS.

In addition to class-room work, I also have had the superintendence of the shops. The work throughout the year has gone on smoothly and profitably. Students in the wood shop have gone through the routine work of learning the use of the various tools, making the various forms of joints, splices and frames, and of turning from models and drawings various articles of intrinsic and ornamental value.

In addition to this routine work, a large amount of pattern making has been done. These patterns of course are of intrinsic value, as one of the steps in the production of a complete machine. They represent the practical application of what the students learn, and embody our best work of the year. In addition to patterns, a large drawing case has been made, capable of holding about 5,000 drawings. This is a valuable acquisition to the Mechanical Drawing Hall, furnishing classified storage for the drawings of all our students during their course. A detailed statement of the work in the wood shop will be found in the appendix accompanying. In the spring term the agricultural freshmen worked in the wood shop in two divisions for a half term. Their attention and progress were good.

In the iron shop the engine nearly completed last year was finished early in the fall term. It has proved very satisfactory, supplying us with an abundance of power, and requiring no changes or repairs. Two iron working lathes have also been completed during the past year, making a total of six made in our shops since their opening. Two more wood lathes have also been made, and a fifteen-inch shaper is well advanced and will be finished early next year. In the wood shop the patterns have been made and we have obtained most of the castings for a combination buzz-saw table. In addition to these larger items, many small tools, appliances and attachments have been made, for a more detailed list of which reference may be made to the appendix following.

This appendix is made out from our time-book, which gives in detail the time spent by each student on each kind and piece of work. This appendix must not be understood as covering all the work of the student. In the wood-shop, especially, a considerable portion of the time is spent on purely practice exercises, the results of which are not included in this summary. It must be also understood that the cash estimates do not include the value of the material. They are simply, as closely as can be estimated, the added value given to the crude material by the work put upon it.

Our greatest need in the machine shop at present is a standard high grade lathe, a need which, it is to be hoped, may be filled in the near future.

In the blacksmith shop the students have been occupied in learning the fundamental operations of forging, welding, tempering, etc., and they also keep the machine shop supplied with lathe and planer tools, and such forgings as are needed.

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During the fall term the sophomore agricultural students worked in the blacksmith shop in four sections, three weeks each. For their instruction Mr. A. Manne, a blacksmith from Lansing, was employed, and their progress during the short time spent was very gratifying, speaking well both for their attention and for Mr. Manne's zeal and aptitude as a teacher.

During the past year the patterns have been made for a new forge for the outfit of the blacksmith shop, those first put in being only intended for temporary use. The change will be made during next year and will add much to the general appearance and utility of the shop.

During the summer term the mechanical freshmen were given some instruction in plain moulding and casting. A brass furnace was put in during the spring term, and we are now enabled to make our own brass castings, a saving of some moment, in addition to the educational value of the work.

The great need of our shop-course, as a whole, is an iron foundry. With that, we should have the complete chain in the development of a machine. In the class-room students learn the theory and practice of design, and make drawings general and detail. In the wood shop they make patterns, and in the iron shop elaborate castings into the finished machine. The link connecting the pattern with the casting is unfortunately omitted at present. This, it may be hoped, the near future will enable us to rectify.

At the State Fair held in Jackson, a display of the work of the students in shop work and drawing was made, which attracted much attention and favorable comment. The exhibit included the shop engine referred to above, four lathes, several smaller engines made by the boys as their personal property, and many small tools and articles in wood and metal.

As a whole the work of the students during the past year has been very gratifying. Our constant effort will be toward an elevation of the grade and standard of work, and an increase of its educational value.

During the winter I attended Institutes at Centreville and Albion, as appointed, and lectured on "The Farmer as a Mechanic."

Very respectfully submitted.

W. F. DURAND,

Prof. of Mechanics and Supt. of Shops.

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Appendix to the Report of the Mechanical Department, being a Statement in Detail of Work Done in the Shops.

Description of Work.	For Mech'l Department.	For Other Departme'ts.
Wood Shop:		
Patterns for shaper	$33 50	
Patterns for saw table	11 00	
Patterns for lathes, drawing stand, etc.	108 40	
Report boxes		87 50
Veterinary tables		16 10
Cases for drawing room		18 60
Cases for Horticultural Department		9 40
Sewer boxes		3 80
Dry kiln	18 80	
Tool rack	6 40	
Total for wood shop	$172 60	$55 40
Iron Shop:		
Lathe "C"	$10 00	
Lathe "D"	39 00	
Lathe "F"	28 70	
Lathe "G"	8 90	
Work for iron lathes	160 20	
Work for wood lathes	71 70	
Tools for shop use	92 30	
Work on shop engine	5 90	
Section cutter		$22 80
Indicator attachments	2 40	
Grinding attachments	6 80	
Shafts and couplings	11 50	
Hydrant caps		4 50
Work for Observatory		2 20
Work on shaper	65 80	
Dynamo	11 70	
Forges	8 80	
Work in blacksmith shop	52 10	
Apparatus	11 80	
Total for iron shop	$607 60	$29 50
Total for wood shop	172 60	55 40
Total for both shops	$780 20	$84 90
Sum total for both shops	$865.10	

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REPORT OF PROFESSOR OF MILITARY SCIENCE AND TACTICS.

To the President Michigan Agricultural College:

SIR—I have the honor to submit the following report of the work done in the Military Department during the college year of 1888–9, and of the condition of the department at the present time.

At the beginning of the fall term of 1888 the military drill became, by previous action of the Faculty, a required exercise for all students in the agricultural course, during the freshmen, sophomore and junior years. During the winter a new work scheme was prepared for students of the mechanical course, and at the beginning of the spring term of 1889, students of this course were enabled to take the drill, and were required to participate in the military training under the same conditions as were prescribed for the agricultural students. These changes brought to the department a large number of undrilled students, and the fall and spring terms were devoted chiefly to the training of these students in the elementary work.

Before the close of the spring term four companies were fully organized and officered, and all partly instructed in the school of the company. A band was organized, several dress parades were held, and work in the school of the battalion commenced.

Since the beginning of the summer term the school of the battalion has been continued, alternating in the regular drills with a continuation and review of work in the school of the company. Dress parade is held at the close of each drill, and training in reviews, inspections and guard mount is in progress. This work will continue until the close of this term.

According to the schedule of the catalogue about to be issued, drill is provided of an hour's duration, for three days per week throughout the college year.

Since my last report there have been introduced into the curriculum of the course, one term's work elective in the senior year, in military science, and one-half term's work required in the sophomore year, in tactics.

A fair idea of the number of students being instructed in the military drill may be obtainod from the following extracts from quarterly returns rendered to the Adjutant General of the U. S. Army:

Quarter Ending March 31, 1889.

Total number of students enrolled	175
Average number of students at drill	97
Number of students in college well instructed	103
" " " " " partially instructed	137
" " " " " uninstructed	16

Quarter Ending June 30, 1889.

Total number of students enrolled	180
Average number of students at drill	142
Number of students in college well instructed	102
" " " " " partially instructed	103
" " " " " uninstructed	14

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While the total number of students in college during the latter quarter is smaller, the enrollment is larger, and the average attendance much larger. The reduced average attendance during the first quarter of the year is accounted for by the fact that much of the drill of the early spring is of necessity in the drill hall, and all cannot drill at once with profit. The absentees are not delinquent students, but students excused from the drill on account of lack of room.

The target practice for cadets has been delayed this year from lack of ammunition. The change brought about by the resignation of President Willits is the main cause of this lack. New requisitions for ordnance supplies could not well be submitted until the ordnance at the college should have been transferred to President Willits' successor, and this transfer required action on the part of the State Board that involved some delay. The department has the promise of two 3-inch field guns from the ordnance department U. S. army, and with these, foot battery drill will be taught.

Some additions have been made to the apparatus in the gymnasium during the year, and more apparatus will yet be added before the new class arrives in August.

RECOMMENDATIONS.

It is much to be desired that all students required to drill should wear the cadet uniform. If wearing the uniform were required, I think it would prove no hardship to any student. Those students desiring time could be allowed one term in which to provide the uniform. The cost of the suits generally ordered ranges from $14 to $25, including the cap. This is a tailor-made suit of good, durable, all-wool cloth, and proves to be an economical dress.

In recommendation further I will repeat from recommendations of last year:

I would recommend that discipline should be given a value in the standing, and a student should be required to be proficient in discipline in order to graduate. All absences from required duties, unless the student be excused by competent authority, would then be looked after by those having charge of the discipline, and would count against the standing of the student.

Students could be marked on the relative attentiveness to work, drill, and college rules generally; and there would be some distinction in standing between the student who is attentive, diligent and obedient in all departments of work and study, and the student who may have nearly merited suspension or expulsion by neglecting drills and shirking work on the garden or farm.

A system could easily be inaugurated of sending in reports for delinquencies to the Commandant of Cadets, who could have them posted and recorded. The students could be required to submit explanations to these reports, and such explanations as should be deemed unsatisfactory could be finally submitted to the President of the College. In his office could be recorded all such delinquencies as were not satisfactorily explained, and the number of demerits fixed for the delinquency entered.

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This is but indicating very briefly the system I propose, but it would be readily developed, and would add much to the justness and fairness to students of the College.

I am, sir, very respectfully,
Your obedient servant,
WENDELL L. SIMPSON,
2d Lieut. 24th Infantry, U. S. Army,
Professor of Military Science and Tactics.

AGRICULTURAL COLLEGE, MICH.,
July, 1889.

REPORT OF THE FLORIST.

To the President of the State Agricultural College:

I herewith respectfully present a report of the work done in the greenhouse and flower garden during the year 1889, and of the condition of the same.

SPRING TERM.

With the assistance of Mr. Louis Bregger, as foreman, and of the students assigned to my department, preparation was made early in the term for planting out-of-door stuff. There was also the sowing and testing of seeds from different firms and counties, the propagating and re-potting of plants, and the preparation of hot-beds and cold frames. Practical instruction in floriculture, and lectures on the same, were given the juniors under my supervision.

SUMMER TERM.

During the early part of the term we were laying out and planting the flower beds. An endeavor was made to show different styles of ornamental planting, including the so-called carpet beds. Annuals were planted in great quantities, and of many varieties, including a patch of 2,000 Chinese asters, of which we gathered the seed last year from our own grounds. At first they did well, but just at blooming time many of them died, a result apparently due to a parasitic fungus.

During the first part of the summer the weather was most favorable, and as a result the flower display was better than in any previous year. The plants in the perennial plant bed were taken up, the bed manured, and the plants divided and re-set. Our collection of perennials is a well-tested one. With a little protection the plants stand our winters pretty well.

The rose house was furnished with good soil—a heavy sandy loam. Its good effects were soon apparent in the improved appearance of the roses, which are now healthy in appearance, and promise abundance of bloom during the coming winter. Repairing of all the greenhouses was done, and all were repainted. The houses were built in 1874. They are getting very old. Something must be done soon to prevent them from falling in.

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FALL TERM.

The weather was very dry all the fall, but by aid of the College water-works we kept the flower beds and lawns in good condition, and had a fine show of flowers until the first frost in September, which was so severe that nearly all the out-door display was killed in a single night. The loss from this frost was not serious, however, for most of the hot-house plants had been taken in. At this season the work consists in taking up all plants that we desire to keep; cleaning off the beds; refilling the beds in the houses with fresh soil, and planting them over with carnations, violets, pansies, mignonettes, etc.; and in taking up the half hardy roses, the hydrangeas, carnations, wall-flowers, etc., and storing them in the cold pits. The compost heaps are also turned over, soil stored in the cellar and bulbs planted out-door and in.

THE GREENHOUSES.

The greenhouses are a source of interest and pleasure to the many visitors who come to the College. This fall they are looking well. The large conservatory is full of healthy plants. In the palm-house the palms and ferns are in fine condition. Many of the old plants had become so large as to be unwieldy. These have been discarded and their places filled with vigorous young plants, which are now growing luxuriantly. The begonia house is full of begonias and chrysanthemums. The former do well, and give us an abundance of beautiful bloom the most of the year. The chrysanthemums are now in splendid condition, and give a gorgeous show of color. Many of the new varieties of this superb plant are of unsurpassed beauty. The cactus house is doing first-rate. Fortunately every cactus was brought from out-door the day before the frost. Not one was injured. Every plant is in good condition. This collection is always a source of interest to visitors. The rose house was improved by giving it deeper beds of new soil, and we have now a fine lot of blooms and the promise of a constant supply for the winter. In the smaller houses we have a large collection of carnations, violets, geraniums, heliotropes, pansies, mignonettes, and general bedding plants for winter bloom, and for bedding out in the spring, all of which are healthy and vigorous.

In all my work I have been ably assisted by Mr. Frank Paine of the last senior class, and by the students assigned to my department, nearly all of whom have pleasure and interest in the work. During a part of the fall term I have had a volunteer class to attend daily lectures by me on floriculture and greenhouse management.

Respectfully yours,

LOUIS KNAPPER,

Sup't of the Greenhouse and Flower Garden and Instructor in Floriculture.

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REPORT OF THE LIBRARIAN

To the President Michigan Agricultural College:

SIR—I have the honor to submit the following report of the condition of the College Library and the work done since my appointment as librarian, at the beginning of the current year:

The library work has been done mostly through student labor. The cataloging of accessions has gone forward according to the plan of my predecessor, and something has been done in advancing the index catalogue.

The library has been freely used by nearly all members of the school, officers and students. The records show the number of books drawn to be 2,821, of which 321 were history, 287 poetry, 1,327 fiction, 177 criticism, 564 science, 145 philosophy.

The accessions for the year have been 438, of which 117 were by purchase, 128 by donation, 193 by binding.

The following is a list of donations and donors, other than State reports and college catalogues:

Brewer, M. S.—Growth of Industrial Art.

Baird, H. W.—Forest Culture and Eucalyptus Trees.

Cooley, Thos. M.—2d An. Rept. Interstate Commerce Commission.

Hough, W. S.—A Critique of Kant.

Hussey, Dr. C. G.—Principles of Economic Philosophy.

Kansas (Agr'l Coll. Library)—Mich. Bd. of Agr'l Repts. for 1852–66–78; Rept. Kan. Hort. Soc'y 1884–5–6; Forestry Rept., 1885–86; Senate Documents, 35th Cong., vol. 16.

Knoblauch, Herr Dr.—5 vols. Nova Acta Academiæ.

Lawton, Chas. D.—Mines and Mineral Statistics, 1888.

Levering, Mortimer—Am. Shropshire Sheep Record.

Mills, W. T.—The Science of Politics.

Perry, Mrs. Benj. F.—Sketches of South Carolina, by Gov. Perry.

Reynolds, Mrs. H. G.—The Dignity of Man, Sermons, by Bishop Harris.

Stockbridge, Hon. F. B.—Message and Documents, 1886–7; Greeley Relief Expedition, 1884; Observations United States Observatory, 1883; Report on Wool and Other Animal Fibers; Report Smithsonian Institute, 1885, part 2d.

Spaulding, Hon. O. L.—4 vols. 10th Census United States; 4 vols. War of the Rebellion.

Taft, Prof. L. R.—The Practical Fruit Grower; 30th An. Rept. Missouri Hort. Soc'y.

Waters, O.—From City to Surf.

Willits, Mrs. Edwin—Gospel Hymns and Sacred Songs; The Gospel Choir.

The following is a list of pamphlets donated, other than public reports:

Agr'l Students' Gazette, regularly.

Alger, Gen. R. A.—Eulogy on Gen. Phil. H. Sheridan.

Browning, Oscar—Aspect of Education.

Craigie, Maj. P. G.—Rept. on French Agr'l Schools.

Forbes, S. A., Ph. D.—Studies on the Chinch Bug.

Gompers, Sam'l—Trade Unions, by Wm. Trant.

The periodicals subscribed for by the Library are as follows, viz.:

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Foreign.

Agricultural Gazette.
Anglia.
Annals of Botany.
Annals de Chimie.
Blackwood's Magazine.
Chemical News.
Contemporary Review.
Edinburgh Review.
Engineer. Discont'd since Jan., '89.
Engineering.
Fortnightly Review.
Garden.
Gardener's Chronicle.
Journal of Anatomy.
Journal of Chemical Society.
Journal of Horticulture.
Journal of Royal Agricultural Soc.
Nature.
Nineteenth Century.
North British Agriculturist.
Observatory.
Quarterly Review.
Revue Horticole.
Revue des Deux Mondes. (Since Jan., 1889.)
Scottish Review.
Spectator.
Veterinarian.
Veterinary Journal.
Westminster Review.

American—By Subscription.

Agricultural Science.
American Agriculturalist.
" Architect.
" Bee Journal.
" Garden.
" Chemical Journal.
" Cultivator.
" Dairyman.
" Journal Science.
" Meteorological Journal.
" Economic Association.
" Journal of Comparative Medicine.
" Journal of Mathematics.
" Library Journal.
" Microscopical Journal.
" Machinist.
" Naturalist.
" Veterinary Review.
Annals of Mathematics.
Andover Review.
Army Journal.
Atlantic Monthly.
Bibliographers.
Book-buyers.
Boston Journal of Chemistry.
Botanical Gazette.
Breeders' Gazette.
Canadian Entomologist.
Century Magazine.
Chicago Tribune.
Harper's Monthly.
" Weekly.
Homestead.
Independent.
Iron Age.
Journal Military Service Institution.
" American Medical Associat'n.
" Franklin Institute.
" Morphology.
Library Journal.
" Notes.
Literary World.
Littell's Living Age.
Metal Worker.
Magazine of American History.
Manufacturer and Builder.
Michigan Dairyman.
" Farmer.
Microscope (discontinued since Jan. 1889).
Nation.
Nature.
National Live Stock Journal.
New York Tribune.
North American Review.
Ohio Farmer.
Popular Science Monthly.
Poultry World.
Prairie Farmer.
Popular Gardening.
Proceedings Academy Natural Science.

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Christian Union.
Clay Worker.
Country Gentleman.
Critic.
Detroit Free Press.
" Tribune.
Drainage Journal.
Education.
Engineer.
Electrical World.
Engineering News.
ntomologica Americana.
Engineering Journal.
Farmers' Review.
Forum.
Garden and Forest.
Psyche.
Quarterly Journal of Economics.
Rural New Yorker.
Sanitary Engineering.
Science.
Science Observer.
Scientific American.
Scientific American Supplement.
Scribner's Magazine.
Shakespeariana.
Siderial Messenger.
Southern Cultivator.
Statesman.
Torrey Bulletins.
The Voice.
Vick's Monthly.

American—By Gift of Publishers or Individuals, or by Exchange for the Experiment Station Bulletins.

Allegan Gazette.
Allegan Record.
Adrian Times.
Albion Recorder.
American.
" Missionary Magazine.
" Sheep Breeder.
" Swine Herd.
Buffalo Journal.
Bee Keeper.
Canadian Horticulturist.
Chicago Medical Journal.
Charlotte Republican.
Charlevoix Journal.
Christian Register.
City and Country.
Clinton Independent.
Coldwater Republican.
Dairy World.
Deaf Mute Mirror.
Dairy Column.
Farm and Fireside.
Farm, Field and Stockman.
Farm Home.
Farmers' Advocate.
Farmers' Club Journal.
Flint Globe.
Fruit Growers' Journal.
Good Health.
Grand Haven Herald.
Grand Traverse Herald.
Ionia Sentinel.
Journal D'Agriculture.
" N. Y. Microscopical Society.
Kalamazoo Telegraph.
Lansing Journal (daily).
" Republican (daily).
Literary News.
Live Stock Commercial.
Locomotive.
Ladies' Home Companion.
Maryland Farmer.
Midland Republican.
Moderator.
Monroe Commercial.
Missionary Review.
National Live Stock Journal.
New England Farmer.
" " Homestead.
National Stockman.
Official Gazette.
Open Court.
Orange Judd Farmer.
Practical Farmer.
Popular Gardening.
Popular Science News.
Roscommon News.
Sacramento Union.
Saginaw Herald (daily).
Sorghum Growers' Guide.
St. Louis Leader.
The Sun.

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Grange Bulletin.
Grange Visitor.
Herds and Flocks.
Hillsdale Leader.
" Standard.
Holstein Freisian Register.
Home Companion.
Homestead (Iowa).
Imports and Exports U. S.
Industrialist.
Ingham County News.
Three Rivers Tribune.
Traverse Bay Eagle.
Toledo News.
Union Signal.
Unitarian Review.
Village Echo.
Watchman.
Weekly Globe.
Western Resources.
Western Agriculturist.
Wolverine Citizen.

Very respectfully submitted.

MARY M. ABBOT,
Librarian.

AGRICULTURAL COLLEGE, MICH.,
July 1, 1889.

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SECOND ANNUAL REPORT

OF THE

AGRICULTURAL

EXPERIMENT STATION

OF THE

STATE AGRICULTURAL COLLEGE OF MICHIGAN

FOR THE

YEAR ENDING JUNE 30, 1889.

[For Members and organization of the Board of Agriculture in charge of the Station and the list of officers, see pp. 4 and 6 of this volume.]

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REPORT OF THE DIRECTOR OF THE EXPERIMENT STATION.

To the State Board of Agriculture:

Work in the Experiment Station during the past year has gone forward with efficiency, and in most cases the results are of interest and of real value. The reports of the heads of the departments are herewith submitted. In some cases the results are given somewhat in detail; in others the details are given in the bulletins which have been issued during the year, or which are soon to appear. All the bulletins for the year are printed in this volume, hence any extended account of the Station work is not necessary in my report.

The excellence of the method on which our Experiment Station is organized is shown by the large amount of work done. That method is to put an important branch of experiment work in charge of one of the professors, whose long training in his specialty has given him knowledge of what needs to be done, and has taught him the best methods of going at it. This chief of a department plans the experiments in his department, and oversees the carrying them out. He is furnished with such trained assistants as are needed, who attend to the details under his direction. In our Station it has been found that the graduates of our College make the best men to be found for assistants to the heads of departments. Our main difficulty is that we cannot keep them, for their training fits them for responsible positions, and they are soon called to other fields at larger salaries. In several instances during the last two years the Station has lost valuable men in this way. In some cases their loss has been a serious drawback to the success of the year's work.

Experimentation has been in progress at the Michigan Agricultural College since the earlier years of its existence, reports of them appearing in the annual volume published by the State Board of Agriculture. After the passage of the Hatch act the Experiment Station was organized under that act, and all experiment work at the College was turned over to the Station. In the twenty-one months since our Station began work under the present organization it has published twenty-one bulletins, nearly all of which contain valuable results. Twelve of these have been published since the date of the last report. Material is prepared for several others, containing results of work in 1889. These will soon be issued. The Station bulletins now have a regular circulation of 4,500 copies. New applications for them are coming in by nearly every mail, and it is found necessary to keep the mailing list "set up," so as to add the new names. Of some of the bulletins

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the first edition has been speedily exhausted, and extra editions of several thousand copies have been published. Some of the leading newspapers of Michigan, and of other States, reprint the most important parts of our bulletins, and so give them a very wide circulation.

The heads of the Station staff hold meetings from time to time for consultation and discussion. By request of the Director the heads of the departments and the State Board of Agriculture will meet in joint session early in December to plan for the still more efficient prosecution of the work. It is very desirable that our plans be carefully made, that they include such research as will in the end prove of greatest value, and then that the staff and the Board of Agriculture coöperate in attaining the ends sought. The friendly interest and sympathy of the Board have thus far been all that could be desired. It is believed that such joint sessions, as the one proposed, will tend to continue and strengthen the coöperation of staff and Board, and so to maintain and increase the efficiency of the Station.

Very respectfully yours,

O. CLUTE,
Director.

AGRICULTURAL COLLEGE,
October 31, 1889.

REPORT OF THE SECRETARY AND TREASURER.

FOR THE YEAR ENDING JUNE 30, 1889.

		Dr.	Cr.
July 1, 1888	By balance due from U. S. Treasury on account of the 4th quarter of previous year		$3,750 00
July 17, "	To U. S. Treasury on account of 4th quarter	$3,750 00	
Oct. 15, "	" " " " " " 1st "	3,750 00	
Jan. 3, 1889	" " " " " " 2d "	3,750 00	
Mar. 28, "	" " " " " " 3d "	3,750 00	
Nov. 30, 1888	To sale of 10 steers used in feeding experiment	786 45	
June 30, 1889	To license fees on 40 commercial fertilizers	800 00	
" "	To miscellaneous receipts, as per accounts filed in the office of the State Auditor General	76 19	
" "	By disbursements, as per vouchers filed in the office of the State Auditor General		16,662 64
" "	To balance due from U. S. Treasury on account of 4th quarter	3,750 00	
		$20,412 64	$20,412 64

SUMMARY OF DISBURSEMENT ACCOUNT.

Buildings—		
To Botanical Laboratory Experiment Rooms	$264 90	
Grayling Experiment Farm, Barn	108 07	
Farm Department, fe d mill	136 11	
Farm Department, stalls etc.	91 65	
		$600 73
Carried forward		$600 73

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Brought forward		$600 73
Salaries—		
To director	$185 83	
secretary and treasurer	333 32	
librarian	120 83	
six heads of departments	3,250 00	
twelve assistants	2,979 76	
		6,869 74
Farm Department—		
To labor	$657 86	
three young steers for feeding experiment	150 00	
eight young heifers for dairy experiment	629 30	
one Jersey bull for dairy experiment	105 00	
six pigs for feeding experiment	60 00	
feed and bedding	663 00	
fat stock show and pictures of fat steers	484 24	
freight, $64.01; traveling, $43.70; seeds, $21.24	128 95	
fertilizers, $111.16; office, $26.85; apparatus, $187.09	325 10	
		3,203 45
Horticultural Department—		
To labor	$111 14	
plants and seeds	229 89	
microscopic, photographic and chemical apparatus	271 90	
freight, $42.50; rent of ground, $51.20; fertilizers, etc., $111.95	205 65	
		818 58
Chemical Department—		
To analysis of commercial fertilizers	$329 65	
apparatus	318 34	
stove, $52.60; postage, $22; sundry, $95.99	170 59	818 58
Botanical Department—		
To labor	212 71	
microscope, lenses and apparatus	253 56	
stove, $35.40; tables, $22; cases, $62.98; seeds, $66.46	186 84	
labels, $30.15; traveling, $22.10; sundry, $60.72	112 97	
		766 08
Zoölogical Department—		
To labor	$117 75	
apiary, $74.97; seeds and fertilizers, $24.45	99 42	
microtome, $40; pressed cork and pins, $45.90	85 90	
freight, $14.21; traveling expenses, $7; sundry, $50.23	71 44	
		374 51
Veterinary Department—		
To labor	$185 50	
apparatus, $265.31; office rent, $83.68	348 99	
feed, $73.02; furniture, $21; sundry, $96.27	190 29	
		724 78
Grayling Station—		
To labor	$556 36	
traveling, $94.26; seeds, $150.58; fertilizers, $55.75	300 59	
rent of land, $40; freight, $10.87; sundry, $45.67	96 54	
		953 49
Other Outlying Stations—		
To labor	$296 75	
traveling expenses, $124.58; fencing, $80	204 58	
South Haven, $50; freight, $7; seeds, $27.40	84 40	
		585 73
Library—		
To books, $548.72; sundry, $13.92		562 64
Offices—		
To traveling expenses to fat stock show and convention	$131 74	
stationery, $44; furniture, $194.25; freight, $14.34	252 59	
		384 33
		$16,662 64

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This expenditure may be more briefly summarized and classified as follows:

Salaries	$6,869 74
Wages	2,138 07
Buildings	600 73
Other property	3,217 45
Seeds and plants	507 82
Traveling expenses	573 38
Feed	736 02
Miscellaneous	2,019 43
	$16,662 64

INVENTORY.

In this inventory I find there are included four steers bred by the College and neither sold nor formally donated to the Experiment Station, viz: One Shorthorn, two Devons and one Holstein, each valued at $50. I also note, that the estimated value of the books in the library is $223.54 less than their cost, a discount of about 17 per cent.

Lands donated to the Station—		
80 acres at Grayling, fenced and improved	$1,850 00	
10 " " Harrison, " " "	300 00	
10 " " Oscoda, " " "	120 00	
		$2,270 00
Buildings—		
Experimental feed barn	$1,200 00	
Horticultural laboratory, experimental rooms	1,200 00	
Apiary	600 00	
		3,000 00
Library and offices—		
Books	$1,085 00	
4 book-cases, 4 doz. filing boxes, carpet, stationery, etc.	369 00	
		1,454 00
Farm Department—		
Implements	$140 36	
13 steers for feeding experiment	650 00	
9 heifers and 1 bull for dairy experiment	850 00	
Feed and office equipment	339 00	
		1,979 36
Horticultural Department—		
Implements	$175 00	
Microscope, camera, balances, etc.	494 25	
		669 25
Chemical Department—		
Sundry apparatus	$617 37	
Chemical and physical balances	529 20	
Horse tools on Grayling farm	146 50	
		1,293 07
Botanical Department—Microscopes and sundry apparatus		510 20
Veterinary Department—Microscopes and sundry apparatus		628 83
Zoölogical Department—		
Microscope, balances and insect cases	$279 34	
Apiary, 35 colonies of bees, tools, etc.	649 35	
		928 69
		$12,733 40

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REPORT OF THE AGRICULTURIST.

[The following is that portion of the report of Prof. Samuel Johnson to the President of the State Board of Agriculture which related to the State Agricultural Experiment Station.—H. G. R., Sec'y.]

* * * * * We have sent out five bulletins from the agricultural department of the Experiment Station during the year.

No. 38.—Experiments with Varieties of Wheat and Amounts of Seed; Fertilizers for Meadow Lands.

No. 41.—Warming Water for Dairy Cows.

No. 44.—Feeding Steers of Different Breeds.

No. 46.—Potatoes, Roots and Oats; Comparison of Varieties; Different Amounts of Seed and Various Fertilizers.

No. 47.—Silos and Ensilage; Seven Years' Experience at the College; Views of Leading Farmers and Stockmen; Ensilage vs. Dried Fodder and Grain; Test of Varieties of Ensilage Corn and Forage Plants.

I take some pleasure in calling the attention of the readers of this report to the live subjects discussed in these bulletins. The work of the department will not suffer in this respect, at least, in comparison with others at home or abroad.

EXPERIMENTAL WORK.

The Farm Department experiments have been fully reported in the bulletins issued and through the agricultural press.

The steers of different breeds, to which attention has been called in former reports, were shown at the State Fair at Jackson, the next week at the West Michigan Fair at Grand Rapids and then at the Central Michigan at Lansing.

The full report of the final showing at the Fat Stock Show at Chicago will be found in bulletin No. 44. The leading farm journals gave special attention to this exhibit, the Rural New Yorker devoting an entire page to photographs of the animals slaughtered and another to notes on the experiment. The Country Gentleman said: "Decidedly *the* feature of the last Chicago Fat Stock Show, so far as its educational and practical rather than its sensational side is concerned." The Mark Lane Express, a leading English agricultural newspaper, whose editor was present at the show, gave considerable space to the report and reproduced the photographs of the meat cuts from the different carcasses.

The second lot of calves for a similar test was purchased during the summer and fall of 1888 and is well under way.

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The Herefords came from Merrill & Fifield, Bay City, and Hon. Wm. Crapo, Flint, John W. Foster, Supt. A Holstein from Hon. M. L. Sweet, Grand Rapids; one Shorthorn from the herd of Wm. Curtis & Sons, Addison; the Galloways from R. B. Caruss of St. Johns and Townsend & Wicks of Colby; the Devons, one Shorthorn and one Holstein were bred at the College.

The Board of Agriculture authorized the purchase of heifers for a dairy test, and two Jerseys from the herds of Hon. Isaac Marston, Bay City, and Smith Bros., Eagle, were selected. W. L. Sexton, Howell, furnished one Holstein and Westover & Seely of Bay City the other; Dwight Curtis of Addison one Shorthorn, the College one. C. M. Winslow, Secretary of the National Ayrshire Association, selected the two Ayrshires bred by Alonzo Libby, Sacarappa, Maine. They are fine specimens, and if properly cared for ought to be valuable for the purpose for which they were purchased.

A Merino lamb from Mr. Chilson of Hanover, Lincolns from G. L. Allen & Sons of Portland, and grade Shropshires raised on the College farm have been fed together in the same experiment.

Duroc Jerseys from the herd of Mr. McBride of Burton, Berkshires from Mr. Hibbard's herd at Bennington, and Poland Chinas and cross-bred Poland China and Berkshire pigs bred at the College were fed last year. A pair of Duroc Jerseys from the same herd, Berkshires from Mr. Hibbard and Poland Chinas from Mr. H. W. Riley, Greenville, were purchased for a repetition of the test and are now being fed.

Several varieties of wheat were tested in acre plats and other varieties in smaller plats. Some fifty varieties of potatoes were planted this season. The testing of varieties of ensilage corn and forage plants was continued; also with roots, oats and buckwheat. The use of different amounts of seed for the purpose of determining the amount required to produce the largest yield, and the comparative test of commercial fertilizers with our more common manures has been continued. The one acre plats of grasses stood the winter well and yielded well. The testing of grasses in not less than acre plats seems the best for experimental purposes, as in smaller plats the yields are not sufficient to fully test their feeding value. * * *

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REPORT OF THE HORTICULTURIST.

To O. Clute, Director:

The report from this department will be a mere statement of the work performed, the methods and results being published in the bulletins.

On taking charge the middle of last August, the only work immediately available was the closing up, so far as was possible without records or notes of previous observations, the tests of varieties that were undertaken by my predecessor. The fruits had all been gathered, and the results that were obtained with such vegetables as escaped the early frosts were given to the public in Bulletin No. 48, entitled "Potatoes, Tomatoes, Kale and Hybridized Squashes." Careful records of the yield, and notes on the appearance of the different varieties were taken, and seed was saved for this year's planting.

The following outline of experiments to be carried on during 1889 was arranged, and preparations were made to begin the work when spring opened:

1. Tests of and experiments with seeds, to determine their purity, vitality, proper depth of sowing, and the effect on their germination of different amounts of heat and moisture.
2. Testing new and standard varieties of fruits and vegetables as to hardiness, vigor, productiveness, quality and freedom from disease; the work to be carried on both on the College grounds and by volunteer observers in different parts of the State.
3. Observations upon the hardiness and general value of the new shade trees and shrubs.
4. Experiments with fertilizers. Effect of same on the growth, hardiness, productiveness, health and quality of fruits and vegetables.
5. Studying the diseases of plants, and testing remedies for them.
6. Trial of various methods and implements of cultivation.
7. Origination of new varieties by selection and crossing.

SEED TESTING.

The seeds used in this experiment were obtained from over a dozen seedsmen, and their vitality was examined by placing them in seed-testers, in seed-boxes, and in some cases in the open ground. A comparison of the results obtained by the different methods indicate that if proper care be given, either one can be depended upon to furnish an approximately correct idea of the

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value of seeds. With new and plump seeds there will be little or no difference, but if the seeds are old or weak the tester will generally show a slightly higher per cent of germination. While the seed-tester is an invaluable aid to the experimenter in testing the germinating power of seeds, the seed-box or open ground, where they are sprouted under the same conditions as in actual practice, will give more reliable testimony as to their real value.

The tests made this year show several things that are of interest:

1. The seeds were, as a rule, well cleaned and free from foreign seeds. In a few cases they were mixed with other varieties.

2. No seedsman, so far as the tests went, is absolutely reliable. While all of them furnished seeds of a high character as a general rule, packets were frequently found that had a very low per cent of germination,—so low, in fact, that if any reliance had been placed upon them for a crop a failure would have resulted.

Most seedsmen claim to test their seed before sending it out, and if it does not germinate 50 to 75 per cent (varying with the kind of seed) it is not sent out, and yet we find of the Autumn Giant Cauliflower not a single seed sprouted, while the Dwarf Erfurt gave 90 per cent. The same was noticeable in lettuce, where of the Boston Curled, from Henderson, only eleven seeds sprouted, while Henderson's All the Year Round gave ninety-five plants.

In the tester the seeds of the different varieties were subjected to the same conditions identically, while in the soil they were sown in parallel rows in shallow seed-boxes. In some cases only three or four kinds, while in others as many as ten or twelve, were placed in one box.

In one instance the following results were obtained from the varieties of lettuce in one box, one hundred seeds of each kind being used.

No. of Row.	Name of Variety.	Seedsman.	Date of Vegetation.	No. Vegetating.	Notes on the Appearance of Plants.
1...	Yellow Seeded Butter.....	Henderson.....	Mar. 18...	92	Strong, even.
2...	Tomhannock	Ely	" 18...	96	Strong, even.
3...	Tomhannock	Burpee	" 18...	69	Somewhat uneven, rather weak.
4...	Rudolph's Liebling.....	Vaughan.....	" 20...	25	Weak, uneven.
5...	Sugar Loaf.....	Gregory.....	" 18...	85	Strong but somewhat uneven.
6...	Silver Ball.....	Burpee	" 24...	30	Very weak.
7...	Oak Leaf.....	Burpee	" 22...	16	Very weak and uneven.
8...	No. 21.....	Vaughan.....	" 19...	62	Rather weak.
9...	Salamander	Henderson.....	" 18...	92	Strong and even.
10..	Boston Market.....	Henderson.....	" 24...	28	Very weak.

The plants were sown on the 12th of March in boxes in the forcing house, the dates of vegetation were taken, and on the 29th the plants were counted and notes on their condition made. Twenty-seven other varieties of lettuce were grown, and these showed fully as great a difference in the per cent of germination.

This must not be taken as an average test of the vitality of the seeds furnished by the above seedsmen, as in other varieties the results may be just the reverse.

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It is noticeable that the varieties with a low vitality require a longer time for germination and are weaker and more uneven than those that give a high per cent of germination.

The quality of the seeds tested indicates that while the seedsmen as a rule send out seeds with a high per cent of germination, they frequently sell seeds that from age or otherwise are worse than worthless.

It is not fair to attribute any dishonest motives to the seedsmen whose seeds were below the normal per cent, and the only value perhaps to the public in the seed tests made by the different stations is to cause the seedsmen to take increased precautions to sell only seeds that are fresh and vigorous, and to show the purchasers the desirability of testing all seeds before planting, and thus saving much labor and perhaps the loss of a crop.

THE MIXING OF SEEDS.

Our seed tests lead us to believe that many if not all seedsmen practice the mixing of their old seeds with the new crop to an extent that cannot fail to be injurious to the purchaser. It was especially marked in the case of the cabbages, where some varieties germinated quickly and gave a high per cent of strong, stocky plants, while of other varieties perhaps 25 per cent sprouted in four days; two or three days after this 20 per cent more appeared, and still later another five per cent. The line between the different germinations was very marked and seems to indicate that some of the seed had been left over and had been mixed with new seed. With such mixtures the tester gave a considerable higher per cent than the seed boxes.

THE TESTS OF VEGETABLES AND FRUITS.

During the winter a large collection of seeds of the new and promising varieties of vegetables was obtained, and, with quite a number of standard sorts for comparison, they were planted at the proper time either in the forcing house or the garden.

In order to learn the value of the novelties in the different parts of the State fifty collections, containing from twelve to thirty varieties each, were made up and sent to persons who agreed to plant them carefully and report results in the fall.

The spring was quite unfavorable to a good stand of the plants, and the long continued cold wet spell in May and June, and the late frosts, were the cause of partial failure with such tender plants as the melons, squashes, cucumbers, corn and lima beans. The insects also were quite troublesome and the striped cucumber beetle and the black flea beetle did serious injury to several crops.

An attempt was made to complete as far as was possible the collections of fruits, both large and small. Among other additions were Russian and hardy seedling apples from the northwest, Russian and other pears, plums and cherries, with a long list of varieties of grapes, strawberries, raspberries and blackberries.

The trees planted in 1887 and 1888 are making a good growth and should bear a small crop next year. The available land for fruits belonging to this department is now all occupied, and at least ten acres should be set apart for next spring's planting.

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SUB-STATION AT SOUTH HAVEN.

The soil and climate at Lansing are quite unlike those on the lake shore, the section where most of the fruit of the State is produced, and tests made here are not strictly reliable there.

In order that we may furnish the fruit growers of that section with opinions of the new varieties of fruits that they could depend upon, arrangements were made in the spring with T. T. Lyon, of South Haven, who has a large experimental plantation of the new fruits, to prepare a report on their behavior with him. This will be published in the early winter, and will, we feel sure, be of great value to the horticulturists of that section, and to a less degree, perhaps, of the State and nation.

THE APPLE ORCHARD.

The old apple orchard is thirty-two years old, and if traditions are correct has only borne one full crop, and that in 1887. For many years it was in sod, and, although the trees made a fair growth, little fruit was produced. The land slopes both from the east and west sides towards the middle of the orchard, and many of the tender varieties have been killed out, so that the center of the tract is quite open. The east half of the orchard, however, has lost but few trees.

In 1885 Prof. Bailey had the lower branches cut out so that a team could pass under the trees, the tops thinned when necessary, and the land broken up.

It has been kept in cultivation without crops since that time. In 1887 one hundred and fifty trees gave nearly 3,000 bushels, and from present indications the crop will be nearly as large this year.

The trees were sprayed for the codling moth soon after the blossoms fell, using about three gallons to a tree of London purple mixed with water, at the rate of one pound to two hundred gallons.

It was applied by means of a field pump, using a "graduating spray" nozzle. This is the most satisfactory apparatus of any thus far tested. Several of our best varieties, such as Fameuse and Northern Spy, are often badly injured by the apple scab, a fungus that forms blotches on the fruit, often rendering it misshapen and unfit for market.

With the hope of finding some fungicide that would prevent it, five mixtures that are recommended by the Department of Agriculture were tried on two trees each. Three of them, solutions of sulphur, sulphuret of potassium and hyposulphite of sodium, seem to have but slight effect, but in the case of the trees sprayed with copper carbonate and ammonia, and "eau celeste" or blue water, the improvement is very marked. Frequent notes will be taken and the fruit when ripe will be assorted and weighed, and the exact effect of the treatment will thus be ascertained. The mixtures are coming into general use for the destruction of all kinds of fungi, and, with the Bordeaux, have given good satisfaction. They are prepared as follows:

1. *Copper carbonate and ammonia.* Mix three ounces of copper carbonate with one quart of ammonia 22° Baumé, and as soon as all action ceases dilute with 22 gallons of water.

2. *Modified eau celeste.* Dissolve 2 pounds of copper sulphate in hot water, and in another vessel dissolve 2½ pounds of carbonate of soda; mix, and before using add 1½ pints of ammonia and dilute to 22 gallons, with water.

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3. *Bordeaux mixture.* Dissolve 6 pounds of copper sulphate in hot water. Slake 4 pounds of lime, mix and dilute with water to 22 gallons.

For the Bordeaux mixture various amounts of copper sulphate have been used, but for most fungi the above has proved effectual. This mixture is more destructive to the fungi than either of the others, but when the portion of the plant used as food is exposed the lime which is deposited is generally an injury to it. In the case of the potato blight and similar fungi, it is preferable to any other mixture.

During the year the department has received a large number of fruits and vegetables for trial. They will be acknowledged in the report of results.

In order that the Station may be of the most value to the farmers of the State it is desirable that all new fruits and vegetables should be sent here for trial before they are placed on the market.

For a thorough test three trees, such as the apple, pear and plum, six raspberry plants and twenty-five strawberry plants should be sent, while from one to two hundred seeds of vegetables will be necessary.

If it is desired the plants will be grown under number, but if the variety has been named the names will be required as an evidence of good faith before any report will be furnished.

L. R. TAFT,
Horticulturist.

MICH. AGR'L COLLEGE,
June 30, 1889.

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REPORT OF THE CHEMIST OF THE EXPERIMENT STATION FOR 1888-89.

Hon. Oscar Clute, Director of the Experiment Station:

SIR—In presenting my annual report as Chemist of the Experiment Station, the work performed and the results reached will be set forth under the following heads:

I.—THE EXPERIMENTAL FARM AT GRAYLING.

This farm of 80 acres in Crawford county is in the heart of what is called the Pine Barrens, and is a fair representative of the light, sandy soils of the State where the principal forest growth is jack pine (*Pinus Banksiana*) and popularly known as Jack Pine Plains. Along with the jack pine there are found scattering trees of Norway pine, shrubs of scarlet oak, red maple, dwarf huckleberry and sand cherry, sweet fern, brakes, and many kinds of bunch grass. The soil is a yellow to brown sand, having little cohesion and small retentive power. Chemical analysis shows the presence of 94 per cent of sand and insoluble silicates, and only 2 per cent of organic matter. The repeated fires that have swept over these plains explain the deficiency in organic matter in these soils, and afford a reason for the kind of forest growth most common on these plains.

When the land is plowed, after clearing off the trees and shrubs, the soil is usually found too open and porous to sustain crops; the rain sinks too rapidly, the capillary power of the soil to bring up moisture from beneath is too feeble, and the root contact with the soil by the plant too imperfect to secure satisfactory growth.

The two conditions to be secured at the very outset after "breaking the ground," is to increase the amount of vegetable matter in the soil, and to secure a good seed bed by compacting the loose sand. For these purposes three measures have been adopted: (1) To keep out the fires that burn up the annual accumulation on the ground of leaves and vegetable materials and even destroy a part of the organic matter in the soil; (2) to raise on the ground plants that will afford the largest amount of organic matter, to be plowed under as green manure, and thus rapidly increase the organic matter in the soil, and available material for the growth of succeeding crops; (3) the free and repeated use of the harrow and roller to compact the soil.

The changes that have been effected in two seasons' growth by these agencies are evident to any one who will examine these experimental fields. The darker color of the soil, its greater firmness and the increased growth of crops all bear witness to a favorable change.

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Fertilizers Used.

The investigation of the capabilities of this soil was conducted entirely on the basis of practical utility—to answer the question whether a man with limited means, and unable to buy costly fertilizers, could hope to make a satisfactory farm on the plains. The use of barn-yard manures was rejected for two good reasons: Because it had been already fully demonstrated that large crops could be grown on the sands with a free use of barn-yard manure, and in the second place the supply of such manure was too limited for the vast area to be occupied. For similar reasons commercial fertilizers were not used in these experiments. It would be easy by the free use of any or all these materials to obtain surprising crops, and astonish the public with a display of crops from the barren sands, but for the settlement of the real problem of the sands, such displays would be as useless as they are surprising.

In like manner, by selecting some unusual soil for experimenting—a beaver meadow or river bottom, where the accumulation of plant food and the supply of soil moisture were exceptional—the crops would outstrip all that could be shown on the characteristic sands of the pine barrens.

Such results and displays are very good for the county fair and the office of the local newspaper, "to show what our county can produce," but they are very far from solving the real problem of the plains. For this purpose a fairly representative soil must be chosen, the conditions of climate and exposure such as prevail in the region, and the fertilizers such as are within the means of farmers of limited means who would make their homes on these cheap lands.

For these reasons three manurial substances have been selected for these experiments, viz., marl, plaster and salt. These are all very cheap materials. The marl, or bog lime, a mixture of carbonates of lime and magnesia with a varying amount of sand and clay, and usually containing a small amount of phosphate of lime, is found in such quantities in the small lakes and bogs of this region that the expense of getting out and onto the land is practically all the expense of using it, the first cost of the material in its bed being nothing. As found in the lakes, the soft quality of the marl and its tendency, when disturbed, to run into a slimy mass, makes the effort to shovel it out difficult. The tendency to assume a semi-fluid character when stirred in water, might be taken advantage of to pump it up into a trough or pipe and let it run off to a platform on dry land, where the excess of water would flow or drain away and leave the marl in good condition for hauling in a few weeks or months at the most. A belt with attached buckets, such as used for elevating wheat, might be mounted on a scow, the lower end of the bucket pump being sunk into the marl bed and capable of being moved about into a fresh position as the marl is exhausted by pumping, the buckets discharging into a hopper to carry the semi-fluid marl by a trough to bed with porous sand for a bottom, through which the water may drain away—some such arrangement to be worked by horse-power, or by hand, might carry the marl to accessible points. If left all winter to freeze and dry it would be in good condition for use in the spring. It is hoped to rig and put to use such marl pump at Grayling in the near future.

These three materials, marl, plaster and salt, are the only manures used on this experimental farm. The marl when used in doses of five tons to the acre

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has shown marked benefit to all the crops to which it has been applied. The clover as a class, spurry, lupines, tall fescue and perennial rye grass, were especially benefited by the marl. A spot of ground on which the marl had been deposited in a body before it was scattered over the rest of the field made a very bright spot of green, visible at some distance, by reason of the increased growth of tall fescue and perennial rye grass sown thereon. There is little danger of using marl too freely on these sandy soils.

Plaster showed much benefit, especially on the leguminous crops, and paid well for its use. It was used freely, 200 pounds to the acre. In beneficial influence it stood next to marl.

Salt seemed to be of no benefit to any of the crops except buckwheat. In many crops it seemed to be a damage, especially to clovers and millet. It was used at the rate of 200 pounds to the acre. The land does not seem to be in condition to be benefited by salt at present. Possibly the small amount of organic matter would hinder the beneficial action of salt.

The Crops Sown.

It was a matter of first importance to find what crop would grow on these sands and yield the largest amount of organic matter to replenish the hungry soil. A variety of seeds were sown, not with the expectation that all would be equally useful or successful, but the knowledge that certain plants are failures under the conditions on the plains is of some value. The plants usually recognized as valuable, either for forage or for green manures, have received first attention.

Plants that under other climatic conditions might be of great value, may be useless in these northern counties by reason of frost or drouth, or both combined.

The following plants have practically been failures on the experimental farm, mainly on account of frost: Cow pea, New Zealand spinach, yellow branching sorghum, martynia, borage and rape.

The cow pea would be of great value if not so easily cut by frost. Much had been expected from white mustard, which has proved so useful on light sands in Europe, but it was of little value here.

The plants moderately successful were blue and yellow lupines, Kentucky blue grass, seven-leaved turnip, timothy (sowed alone) and meadow fox-tail. The blue and yellow lupines took a very strong hold on the soil and made a strong growth if the frost was not too severe. The energy with which the lupines attack the soil has give the plant its name (Lupus, a wolf). But the blue and yellow lupines do not seem to withstand the frost as well as the more hardy white lupine. Timothy sowed by itself, and for a first crop, made very moderate growth, but when sowed as a second crop with June clover, it made a very satisfactory meadow sward. Blue grass made almost no catch, perhaps from poor seed. The seven-leaved turnip did not make as good top growth as the white turnip, leaving out of account the tubers of the latter.

The following plants have been a success on the Experimental Farm: Spurry, mammoth clover, June clover, alfalfa, white clover, vetch, field peas, Hungarian grass, millet, buckwheat, rye, Bokhara clover, perennial rye grass, tall fescue and white turnips.

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The spurry has shown wonderful productiveness and seed production. When partially ripened and plowed under with a very shallow furrow it is self-seeding and produces an abundant crop. Its value as a manurial plant on these light sands is pronounced. When plowed under it seems to enrich the soil the most rapidly of all plants used. It is valuable for a fodder plant, being readily eaten by cows and sheep. It is said to be very valuable for cows giving milk. It is a plant of first value in bringing these sands into productive fields.

Both the red clovers have done very satisfactorily. Their deeply penetrating roots enable them to resist drought and their ability to withstand frost make them valuable plants for the plains. Their value both as fodder and for manure are so well known that no words are needed on these points. The plants make a vigorous growth as individual plants, but do not cover the ground with an even sward, but they improve when following other crops. The flea-beetle has proved destructive to these clovers when they first come up. The cut-worms were very destructive last May on the well-grown plants.

The alfalfa made a very good growth and its strong roots penetrated the soil to great depth; a plant of good promise on the sands.

White clover made a good sward and promises well.

Rye made a poor growth the first year on newly-broken soil; the second year after a crop of millet plowed under, it made a good growth, "shoulder high," which was plowed under when ripe, and a new crop of great promise is now growing.

Buckwheat made a fair growth the first year, but after a crop of spurry the buckwheat was "just immense," to quote the words of an intelligent examiner.

The Hungarian grass and millet made a good growth on lands just broken, and the second year made a very satisfactory crop, heavy growth and well filled with seed.

Field peas made a good growth and a satisfactory crop, which, instead of being harvested, was plowed under, and a very vigorous second growth is now coming forward. Peas promise good results as a manurial crop.

White turnips made a good growth and produced a fair crop of tubers on the first breaking of the soil.

A crop of spurry after the turnips made a very fine strong growth.

The perennial rye grass and tall fescue give great promise as meadow grasses. They seem to more completely form a sward than any of the grasses or forage plants tried.

Influence of a Manurial Crop.

It is difficult to point out on each crop the effect of a green crop plowed under the preceding year; yet the influence was marked in all the crops. A very intelligent and close observer who has watched this experiment month by month from the very beginning, estimates that the increase by reason of the manurial crop is at least seventy-five per cent on the average of all, and one hundred per cent in some of the crops.

Many persons offer suggestions of ways to solve this problem of the sands, and such suggestions are always welcomed, even if not adopted. The end proposed by the Chemist is to follow lines of investigation which will be

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open to all, and not involve very large expenditure. It is well known that the deficient supply of moisture in the soil during the growing season is a serious difficulty in cultivating these sands. One writer suggests a plan of irrigation by using the rivers of this region for that purpose. But when we consider the large use of these streams for lumbering enterprises, the expense involved in irrigating works on the large scale, and that only a part of these plains could thus be irrigated, this plan does not seem feasible at the present time.

As in most undertakings where time is required for working out results so as to reach reliable data, many persons are crying out for quicker results, and intimating that time is squandered and money wasted without benefit to the public. While all would be delighted to arrive at the true solution of these questions with all celerity, thoughtful persons will concede that little is to be gained by impatient haste for immediate results.

If these lands can be brought to such a condition of productiveness that they can be converted into stock-feeding farms, where only wool, meat and dairy products are sold off the land, and all the rest of the produce is returned to the soil to further increase its productiveness, the problem of the sands will be in a fair way for solution.

II. RELATION OF CULTIVATION TO SOIL MOISTURE.

The influence of the condition of the surface soil on the content of moisture in the soil has attracted the attention of thoughtful observers. Some investigation has been made on this subject, both at the experimental farm at Grayling and at the College. Specimens of soil were carefully examined for the per cent of moisture they contained at different periods during the growing season from May to October, 1889. Five plats of ground at each station were selected of uniform character and in close proximity. The soil at the College was sandy loam; at Grayling, sand. One plat was cultivated repeatedly during the season, viz: at each time of gathering the specimen for analysis. A common one-horse cultivator was used. A second plat was raked over with a garden rake at each time of collecting the specimens. A third plat was left without treatment, or in naked fallow with nothing growing on it. A fourth plat was in meadow (timothy sod), but raked with an iron rake at each time of gathering specimens. The fifth plat was timothy meadow, with no treatment. Two sets of specimens were gathered each time, a surface soil, taking the upper eight inches in each case, and an under soil, taking the soil between eight and sixteen inches from the surface. The soil was at once placed in quart fruit jars, closed air tight, packed in boxes with sawdust to screen them from any possible drying influence, and taken to the laboratory for analysis. The soil from both stations was treated substantially in the same way, but the soil from Grayling had to be sent 170 miles by railway.

It was designed to have the soils gathered at the same dates, but the correspondence of time failed to be realized. The following tables give the results:

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TABLE 1.—*Percentage of Moisture in Soils Collected at Agricultural College, 1889.*

Date of Collecting.	Plowed Land.						Grass Lands.			
	Cultivated.		Raked.		Unworked.		Raked.		Unworked.	
	1st 8 Inches.	2d 8 Inches.	1st 8 Inches.	2d 8 Inches.	1st 8 Inches.	2d 8 Inches.	1st 8 Inches.	2d 8 Inches.	1st 8 Inches.	2d 8 Inches.
May 25	16.25	15.10	17.85	9.52	13.50	12.20	7.44	2.72	8.06	3.50
July 8	14.50	11.83	11.36	8.28	10.86	11.08	.....	.....	6.52	6.77
" 25	16.15	12.15	13.91	9.08	12.07	11.93	7.63	3.70	8.20	4.35
August 1	14.07	12.22	12.25	7.03	12.80	10.70	8.00	5.75	9.07	5.18
" 12	14.73	9.44	13.07	6.95	12.34	9.92	3.17	2.43	3.75	2.36
" 19	14.23	13.50	13.20	8.70	11.22	11.82	3.44	2.63	3.32	2.62
" 25	12.55	12.34	10.52	3.05	11.30	10.80	2.30	1.90	2.76	2.54
September 2	13.40	8.70	10.00	5.22	6.60	6.60	2.21	2.00	2.15	2.04
" 11	11.33	8.29	7.93	5.18	9.83	7.58	2.85	1.83	2.49	1.87
" 27	10.44	7.40	9.81	4.18	8.73	6.51	3.00	2.18	2.90	1.75
October 4	10.90	8.80	7.50	6.05	4.70	4.06	3.87	2.43	2.95	2.30
" 11	9.55	8.20	5.94	4.50	5 60	4.50	2.84	2.14	2.52	1.88
" 18	12.50	5.52	8.15	5.90	9.00	6.80	2.93	2.20	2.45	2.05
Means	13.89	10.27	10.88	6.44	9.89	8.73	4.14	2.66	4.09	3.01

TABLE 2.—*Percentage of Moisture in Soils Collected at Grayling, 1889.*

Date of Collecting.	Plowed Land.						Grass Land.			
	Cultivated.		Raked.		Unworked.		Raked.		Unworked.	
	1st 8 Inches.	2d 8 Inches.	1st 8 Inches.	2d 8 Inches.	1st 8 Inches.	2d 8 Inches.	1st 8 Inches.	2d 8 Inches.	1st 8 Inches.	2d 8 Inches.
May	5.67	5.14	5.70	4.69	6.81	5.00	5.98	5.68	6.06	5.15
July	5.18	4.09	5.40	4.00	4.02	4.88	2.04	2.71	2.00	.....
August	4.61	5.61	6.57	4.76	5.64	3.72	4.90	3.91	4.81	4.88
October 1	6.87	5.75	8.12	5.45	7.08	4.90	7.58	5.46	7.56	6.05
Means	5.58	5.15	6.45	4.72	5.89	4.50	5.12	4.44	5.11	5.34

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These tables present some interesting results, but in order to see their exact bearing, the rainfall for the season must be considered.

	Rainfall at College, Inches.	Rainfall at Grayling, Inches.
1889. May	3.61	2.85
June	3 42	4.05
July	3.41	3.55
August	.68	1.95
September	.79	.70
October	.65	.78

From the 1st of August to the 31st of October there were 2.12 inches of rainfall at the College, yet the average percentage of water in the cultivated surface soil was 13.89, just 3 per cent more than similar soil left as naked fallow. From September 27 to October 18, without a drop of rainfall, this cultivated soil increased 2 per cent in moisture without any corresponding change in the layer of soil immediately below it. The raked surface soil had 1 per cent more water than the naked fallow, but 2 per cent less than the cultivated soil.

In the sands at Grayling the benefit from cultivating does not appear, and only slight benefit from raking. The smaller percentage of water in the grass lands in both stations is marked. These might be expected from the large amount of evaporating surface of the grass plants and the demand for moisture from the soil. The raking of the grass was done to see if harrowing or scratching the surface would tend to keep meadows moist the same as plow-land. No influence of this kind is apparent.

These experiments on soil moisture as modified by the physical condition of the soil will be repeated and extended another year, and an effort will be made to ascertain the influence of rolling and compacting the surface soil.

III.—SOIL TEMPERATURE.

Observations on the temperature of the soil at various depths during the growing season have been made at the College and at Grayling. The soil thermometers were made by Green, of New York, and the temperature was observed thrice daily, at 3, 6, 9, 12 and 24 inches below the surface. The record is given in the following tables, from the 1st of April to the 31st of October for both localities.

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE, APRIL, 1889.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
April 1....	33½	34	34	35	35½	42	38½	37	35½	36½	39	38½	38	37½	36½
" 2....	37	37	37½	37½	37	43½	40	38	37½	37	41	40½	39½	38½	37
" 3....	39½	39½	39½	39	37½	39	39½	39	39	38	39	40	39	39	38
" 4....	35½	36½	37½	38	38	42½	39½	38	38	38	40	40½	40	38½	38
" 5....	35	36½	37½	38	38	42	39½	37½	37½	38	37½	38½	38½	38	37½
" 6....	33½	35	36½	37	37½	46	40½	37	37	38	.....	.....	.....	39	38½
" 7....	37	37	38½	39	38½	50½	45	40½	39	38½	48	47	44	41½	38½
" 8....	40½	41	41½	41½	39½	46	43½	42	41½	40	46½	46	44	42½	40
" 9....	44	44	44	43	40½	51½	47½	44½	43½	41	51	50	47	45	41
" 10....	43	44	45	45	42	57	51	46½	45	42½	50½	51	50	47½	43
" 11....	46½	47	47½	47	43½	49½	48	47	46½	44	49½	49	47½	46½	43½
" 12....	46½	47	47	46½	44	46	46½	46½	46½	44	.....	.....	.....	.....	.....
" 13....	38	40	42½	43½	44	53	48	45	43½	43½	48	48½	47	45½	43½
" 14....	39	40½	43	44	44	53½	49	45	44	43½	49½	49½	48	45½	43½
" 15....	40	42½	44½	45	44	55½	50	46	45	44½	51½	51½	49	46½	44
" 16....	43	44	46	46½	45	60½	54	49	46	45	54½	54½	52	49	45
" 17....	44½	46½	48	48	45½	62	55½	50	48	46	58	57	54	50	46
" 18....	50	51	51	50½	47	63½	58	52½	50½	47	59	58½	56	52	47½
" 19....	56	55	53	53	48½	59	57	55	53	48½	.....	.....	.....	.....	.....
" 20....	52	52	53	53	49	65	59	54½	52½	49½	60	60½	58½	55	49½
" 21....	53	53	54	54	50½	64	59½	55½	53½	51	59	60	58	55	51
" 22....	48	49	52	52½	51	61	56½	53	52	51	58	58½	56½	54	50½
" 23....	48	49½	51½	52½	51	60	56½	53	52	51	56½	56	55½	53½	50½
" 24....	52	53	53½	53	51	62	57½	54½	53	51	53½	55½	55½	54½	52
" 25....	48½	50	51½	52½	51	49	49	50	51½	51	48	49	50	51½	50½
" 26....	46	47	48	49	49½	56	51	49	49½	49½	57	55	53	50½	49
" 27....	47½	49	50	50½	49½	51	50	50	50	49½	50½	51	50½	50	49½
" 28....	48	48½	49	49½	49	53	51	50	49½	49	50	51	50½	50	49
" 29....	45	46½	48½	49	49	47	47	47½	48	49	46	47	47½	48	48½
" 30....	42½	44½	46	47	48	47½	46½	46	46½	48	46½	47	47	47	47½
Means.....	43.7	44.7	45.7	46.0	44.9	52.6	49.1	46.6	45.8	44.8	49.9	50.0	48.7	46.8	44.6

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE MAY, 1889.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in Inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
May 1	41	42	44⅛	46	47⅛	54	50⅛	47⅛	46	47	49	49	49⅛	48	47
" 2	44⅛	46	47	47⅛	47	48	47	47	47	47	47	47⅛	47⅛	47	47
" 3	42	43	45	46	47	62	54⅛	48⅛	46⅛	47	56	54	56	50⅛	47
" 4	48⅛	49⅛	50	50	48	64	57	52	50	48⅛	59	56	59	52⅛	48⅛
" 5	52⅛	52	52⅛	52⅛	49⅛	67	60	55	52⅛	49⅛	62⅛	58⅛	61	55	49⅛
" 6	55⅛	55⅛	55⅛	55	51	68	62	57	55	51⅛	67	61	65	57	51⅛
" 7	59⅛	59	58⅛	57⅛	52⅛	73	66	60⅛	58	53	64⅛	64⅛	68	60	53
" 8	63⅛	62⅛	62	60⅛	54⅛	76	69	63⅛	60⅛	55	71	63⅛	67	60⅛	55⅛
" 9	65⅛	64	63	62⅛	56⅛	75⅛	69	65	62	57	72	67	70	63⅛	57
" 10	65	65	64⅛	63	57⅛	75	69	65	63	58	73	68	72	64⅛	58
" 11	63	64	64⅛	63⅛	58⅛	80	71⅛	66	63½	59	73	69	72⅛	65⅛	59
" 12	61½	62	64	63⅛	59½	78½	70	65	63	59⅛	72	68	71	65	59⅛
" 13	60⅛	62⅛	63½	63⅛	60	63	62	62½	62½	60	62	62	62	61⅛	59½
" 14	57⅛	59	60	60⅛	59	75	66	61	60	59	71	65	69	62	58⅛
" 15	58⅛	60	61⅛	61⅛	59	62	61	61	60⅛	59	60⅛	60⅛	61	60	58⅛
" 16	57⅛	58⅛	59⅛	59⅛	58	58	58	58	59	58	62	60	61⅛	59⅛	58
" 17	61	60⅛	60	59	57⅛	73⅛	68⅛	63	60	57⅛	70⅛	66	69	62⅛	58
" 18	65	64⅛	64	63	59	80	73⅛	67	63⅛	59	74⅛	69⅛	73	65½	59⅛
" 19	63	64	65	63⅛	60⅛	69	66⅛	65	63⅛	60⅛	65	66	66	64	60⅛
" 20	59	60	61⅛	62	60⅛	72⅛	67⅛	64	62	60	64	66	66	64	60
" 21	54⅛	57	59⅛	61	60	54⅛	56	58	59	59⅛	53⅛	57	55⅛	58⅛	59
" 22	49⅛	51	53⅛	56	58	54	53	53½	55	57	54	55	55	55⅛	56⅛
" 23	48	50	52	54	56	52⅛	52⅛	53	54	57	53⅛	54	53⅛	56⅛	56⅛
" 24	52	52⅛	53⅛	54⅛	55⅛	69	63	58	55⅛	55⅛	62	60⅛	62	58	55
" 25	51	53⅛	56	57	56	62⅛	59⅛	57	56⅛	56	58⅛	58½	59	57⅛	55⅛
" 26	50⅛	53	55	56	56	68	62	57⅛	56	56	62⅛	60½	62	58	55⅛
" 27	55	56	57	57⅛	56	55	56⅛	56⅛	57	56	54	56	55	56⅛	56
" 28	45	49	52	54	55⅛	63	58	54	53⅛	55	57⅛	57⅛	58	56	54
" 29	49⅛	52	54	55	55	50	51⅛	53	54	55	48⅛	52⅛	50	53	54⅛
" 30	44⅛	46⅛	49	51	53⅛	45	46⅛	48	50	53	44⅛	47⅛	46	49⅛	52⅛
" 31	44⅛	45	46⅛	48	51⅛	48	47	47⅛	48	51	48½	48⅛	48⅛	49	50⅛
Means	54 5	55 4	56.6	56.9	55.3	64.4	60.4	57.7	56.6	55.4	61.0	59.6	61.0	57.9	55.5

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE, JUNE, 1889.

DATE.	7 A. M.					1 P. M.					7 P. M.				
Depth in Inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
June 1....	47	47⅜	48⅜	49	50⅜	49⅜	49	49	49	50⅜	47⅜	49	49⅜	49⅜	50⅜
" 2....	47	48	48⅜	49	50⅜	48⅜	48⅜	49	49⅜	50	49	49	49	49½	50
" 3....	48	48	48⅜	49	50	52⅜	51	49⅜	49⅜	50	51	51	51	50	50
" 4....	48⅜	49	50	50	50	55½	53	51	50½	50⅜	52⅜	53	52	51⅜	50⅜
" 5....	50⅜	51	51⅜	51⅜	50⅜	66	59	54	52	51	56	57	56⅜	55	51⅜
" 6....	51	52⅜	53⅜	54	52	69	61½	56⅜	54⅜	52⅜	63	62⅜	60	57⅜	52⅜
" 7....	58	58	58	57	54	60⅜	59⅜	58	57	54	60	59⅜	58	57	54⅜
" 8....	60	59	58⅜	57⅜	55	58⅜	59	58⅜	58	55	57⅜	58	58	57⅜	55
" 9....	55	55⅜	56	56⅜	55	64	60	57	56⅜	55	61⅜	61	59⅜	58	55
" 10....	55	57	57⅜	57	55	56⅜	57	57	57	55⅜	56	56⅜	57	56⅜	55
" 11....	54	55	55⅜	56	55⅜	66⅜	62	58	56	55	61⅜	61⅜	60	58⅜	55
" 12....	56⅜	57	58	58	55⅜	70⅜	64⅜	60	58	56	66	65	63	60⅜	56⅜
" 13....	60	60	60	60	57	73	67	62⅜	60	57⅜	68⅜	67⅜	65⅜	62⅜	57⅜
" 14....	62	62	63	62	58⅜	73⅜	69	65	62⅜	59	70	69	67	64	59
" 15....	65⅜	65	65	64	60	72⅜	69	66	64	60	70	69	67⅜	65	60
" 16....	65	65	65	64⅜	61	69	67	65	64	61	68	67	66	64⅜	61
" 17....	65	65	65	64⅜	61⅜	70	68	66	64⅜	61⅜	68	68⅜	67	65	61⅜
" 18....	63	63⅜	64	64	61⅜	71⅜	69	65	64	61⅜	69⅜	69⅜	68	65⅜	61⅜
" 19....	67⅜	67	66⅜	65	62	77	72	68	66	62⅜	72⅜	72	70	68	62⅜
" 20....	64⅜	65⅜	67⅜	66⅜	63⅜	73⅜	71	68	66	63⅜	70	70	69	67⅜	63⅜
" 21....	66⅜	66⅜	67	66⅜	63⅜	67⅜	67	66⅜	66	64	65⅜	66	66⅜	66	63⅜
" 22....	61	62	63	64	63	63⅜	63	63	63	63	62	62⅜	63	62⅜	62⅜
" 23....	57⅜	58	59⅜	61	62	68⅜	64⅜	62	61	61⅜	65	65	63⅜	62⅜	61
" 24....	58	59	61	61⅜	61⅜	66⅜	63⅜	61⅜	61⅜	61	64	64	63⅜	62⅜	61
" 25....	50	60	61	61⅜	61	71	66⅜	63	62	61	69	68	66	64	61
" 26....	63	63⅜	64	64	61⅜	72⅜	69	65⅜	64	62	70	69	67⅜	65⅜	62
" 27....	65	65	65⅜	65	62⅜	77⅜	72	67⅜	65⅜	63	71⅜	71	70	68	63
" 28....	67	67	68	67	63⅜	79	72⅜	69	64	64	75	74	71⅜	69	64
" 29....	68	68⅜	68⅜	68⅜	65	80	74⅜	70⅜	68⅜	65	74⅜	74	72⅜	72⅜	65
" 30....	70⅜	70	70	69⅜	66	78⅜	73⅜	71	69	66	75	74	72⅜	72⅜	66
Means....	59.0	59.7	60.2	60.1	58.3	67.4	64.1	61.4	60.1	58.4	64.3	64.1	63.0	61.4	58.4

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE, JULY, 1889.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in inches	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
July 1	68½	69	70	69½	66½	84	72	72	70	67	78½	77½	75	72	67
" 2	71	71½	72	71½	67½	85½	79	74	71½	67½	79½	78½	76½	73½	68
" 3	73	73½	73½	72½	68½	76	74½	73	72	68½	72½	73	73	72	68½
" 4	65	66	68	69	68	74½	74	70½	69	67½	72	73	72	70½	67
" 5	65	67½	68½	69	67½	78	73½	70½	69	67½	74	74	72½	70½	67
" 6	67	68	69	69½	67½	81	75	70½	69½	67½	76	76	74	71½	67½
" 7	70	70	70½	70½	68	82	77	73½	70½	68	77½	77	75	72	68
" 8	70½	71	71½	71½	68½	82½	77	73	71½	68½	79	78	75½	73	68½
" 9	72	72½	73	72	69	84½	78	74½	72½	69½	80½	79	77	74	69
" 10	73	73½	74	73½	70	81	78	74	72½	70½	.....	.....	.....	.....	.....
" 11	69	71	72½	72½	70	88	79	74½	72½	70	80	80	77½	74½	70
" 12	69½	71½	73	73	70	85½	78	74	72½	70	81	80	77	74	70
" 13	73	74	74	73½	70½	89	80	75½	73½	70½	81½	80½	78	75	70
" 14	71	72	73½	73½	70½	69	70½	72	72½	70½	66	68	70	71	70
" 15	64½	65½	67	68½	69	78½	73½	70½	68½	69	74	74	73½	71	68½
" 16	65	67	69	70	68½	81	75½	71½	70	69	76	76	75	72	68½
" 17	67	69	71	71	69	76	73½	71½	70	69	75½	75	73½	71½	69
" 18	68	70	71	71	69	73½	72	71	70½	69	73½	74	73	71½	69
" 19	71½	71½	71½	71½	69	77	74½	73	71½	69	75½	75	74	72½	69
" 20	69	70	70½	71	69	72	70½	70	70	69	71½	71	71	70½	68½
" 21	66½	67	68	69	68½	76½	73	70	69	68½	74	73½	72½	70½	68
" 22	67	68½	69½	70	68½	81	76	72½	70½	69	76	76½	75	73	69
" 23	67	69	71	71	69	77½	74	72	71	69½	75	75	74	72½	69
" 24	66	68	70	70½	69	82½	75½	70½	70	69	75½	76	75	72½	69
" 25	65½	68	70	70½	69	84	76½	72	70	69	76½	77	75½	73	69
" 26	69½	70	71½	72	69½	72½	71½	71½	71	69	73½	73	72	71	69
" 27	68½	69	70½	70½	69	81½	76	72½	70½	69	79	77½	75½	72½	69
" 28	67½	68	69	70	69	78	74	71½	70	69	74½	74½	73½	72	69
" 29	67	68½	70	71	69	68	68½	69	69½	69	68½	69	69	68½	68½
" 30	64½	66	67½	68	68	77½	72½	69½	68½	68	72½	72½	72	70½	68
" 31	64½	66	68	69	68	80	74	70½	68½	68	75	75	74	71½	68
Means	68.3	69.4	70.6	70.8	68.8	79.3	74.7	72.0	70.7	68.8	75.5	75.8	74.0	72.0	68.6

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE, AUGUST, 1889.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in Inches..	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
August 1..	66½	68	69½	70	68½	75	72½	70½	69½	68½	73	73	72½	71	68½
" 2..	68½	69	70	70	68½	76	73	71	70	68½	73½	74	73	71½	68½
" 3..	68	69	69½	70	68½	79	74	71¼	69¾	69½	75	75	74	71½	68
" 4..	66½	67	69	69½	68½	83½	76¼	71½	70	68½	78	77	75	72	68½
" 5..	68	70	70½	71	69	78½	73	71	70½	69	76	75	74	71½	68½
" 6..	64½	67½	69½	70½	69	81½	74½	71	70	69	78	77½	74½	72	68½
" 7..	67	68½	70½	71	69	80½	74	71	70½	69	78½	77	74½	72	68¾
" 8..	69	70	71	71½	69	74	72	71	70½	69	72½	72½	72	71	69
" 9..	69½	70	70	70	68½	71	70	70	70	68½	69	71	70	70	68½
" 10..	63	65	68	69	68	77¼	73	69½	68½	68	71	72	71	70	67½
" 11..	61	63½	67	68½	68	83½	75½	70	68¾	68	73	74	73	71	67½
" 12..	63	66	68½	69½	68	80	73½	70	69½	68½	78	77	74	71	68
" 13..	69½	70	71	71	68¾	75	72½	70¾	70	68¼	70½	72	71½	70½	68
" 14..	68	68	69¼	70	68¼	69½	68½	69	69½	68	68	68½	69	69	68
" 15..	63½	64	66	67½	67½	75	71	68	67¾	67½	67	67	68½	69	67
" 16..	62½	64½	67	68	67	73	69½	67½	67	67	71½	71½	70	68	66½
" 17..	61½	63½	66	67½	66¾	76½	71	67½	67	67	71	72	71	69	67
" 18..	63½	65¼	67¼	68	66½	75	70½	68	67½	67	73	71¾	70¾	68¾	66¾
" 19..	67	68	69	68¾	66¾	80	74	71	68½	67	75	74½	73	70½	67
" 20..	70	70½	71	70½	67¼	78	73½	71¼	70	67½	76½	75	73	71	67½
" 21..	71¼	71¼	71¾	71	67¾	77½	74	72	70¾	68	73½	74	73	71¼	68
" 22..	65½	67½	69½	70	68	80½	73½	70½	69½	68¼	75½	75	72½	70½	68
" 23..	65	67½	69½	70	68	78½	73¼	70½	69½	68½	77	74¾	72	70	68
" 24..	66¼	68¼	69¾	70¼	68	77½	72	70	69½	68½	75½	74½	72	70¾	68
" 25..	66½	68	69½	69¾	68	80½	74	71	70	68¼	78	76	73	70¼	68
" 26..	69	69½	70½	70½	68½	78½	74½	71	70½	68½	77	75	73	71	68¼
" 27..	69	70½	71½	71½	68½	83½	78	73	71	68¾	80	78	74½	71½	68½
" 28..	68½	70½	72	72	69	81½	74½	72	71½	69	79	78	74½	72	69
" 29	68½	70½	72	72	69	83	75	72½	72½	69½	78	77¾	75	72½	69
" 30..	70½	72	73	72½	69	83	76	73	72½	69½	81	79	75½	73	69¼
" 31..	71	72	73	73	69½	82	75½	73¼	72½	70	79	78	76	73	70
Means.....	66.6	68.2	69.7	70.1	68.2	75.8	73.3	70.6	69.8	68.4	74.9	74.6	72.7	70.8	68.1

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE, SEPTEMBER, 1882.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in inches.	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
Sept. 1	70	71	72½	72½	70	85½	77	73	72	70	80½	78½	75	72½	69½
" 2	71½	72½	73	73	70	79	75	73	72½	70	78	77	74½	73	70
" 3	72½	73	73½	73	70	76	74	73	72½	70	75	75	73	73	70
" 4	72	72½	73	72½	70	77	74	72½	72	70	77	75½	74½	72½	70
" 5	70	72	73	72½	70	70	70½	71½	72	70	66	67½	69½	71	70
" 6	60½	63	65½	68½	69½	70½	68	67	67½	69	67½	68½	69	69	68½
" 7	60½	62½	65	67½	68	73	69	67	67	68½	68½	70	70	69	68
" 8	63	64	66	68	68	76½	71½	68½	68	68	74½	73	71½	69	67½
" 9	64½	66	68	69	67½	72½	69	68½	68½	68	71½	71½	71	69½	67½
" 10	67½	68	69	69½	68	78	73	69½	68½	68	74	74	73	71	67½
" 11	68	69½	70	70½	68	81	74	71	70½	68½	77½	76	74	71½	68½
" 12	67	70	71	71	68½	79	73½	71	71	69	72½	74	73½	71½	68½
" 13	66½	69½	70½	70½	68½	70½	69½	69½	70	69	70½	71	70	69½	68
" 14	68	69	69½	69½	68½	73	74	70	69½	68½	76	75	72	70	68
" 15	69½	70	71	70½	68	74	73	70½	70½	68½	70	71	71½	70½	68½
" 16	58½	62	66½	68½	68	62½	63	65	67	68	61½	63	65	67	68
" 17	53	56½	62	65	67	62	60½	62	64	66½	56½	59½	63½	64	66½
" 18	51½	54½	60	62½	65	55½	57½	59½	62	65	56½	59	60	62	65
" 19	52	56	58½	61	64	62	58	58½	60½	64	61½	61½	61	61	63½
" 20	57½	59½	60½	61½	63½	59	59½	60	61½	63	55	57	59	60½	62
" 21	49	52½	57	60½	62½	54½	55	58½	59	62½	55½	56½	57	59	62
" 22	46	52	55	58	61½	61½	55	54½	57½	61½	60½	60	58½	58½	61
" 23	54	55½	57	58½	61	62½	58½	58	59	61	68	61½	60	59½	60½
" 24	56	59	60	60½	61	69½	61½	60	60½	61½	67½	66	63½	61½	61
" 25	64	64	64	63	61½	62	63	63½	63	61½	67½	61	63	62	61
" 26	49½	56½	58½	61	61½	51½	55	57	60	61½	51½	55½	57	69	61½
" 27	45	51½	54	57½	60½	54	54	57	57	60½	53	55	55	56½	60
" 28	48½	52½	54½	56½	59½	71	59	55	56½	59½	62½	62	59	57½	59
" 29	57	54½	57	58½	59½	59½	58	57	58	59½	59	59	58	58	59½
" 30	55½	56	57½	58½	59	57	57½	57½	58½	59	57	57½	58	58½	59
Means	60.3	62.5	64.4	65.6	65.6	68.0	65.3	64.6	65.2	65.7	66.2	66.4	66.0	65.9	65.3

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RECORD OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE, OCTOBER, 1889.

Date.	7 A. M.					1 P. M.					7 P. M.				
Depth in Inches	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
Oct. 1	55	56	57½	58½	59	57	57	57½	58	59	54	55	57½	58¼	59
" 2	50	51	55	57½	59	62½	59	55	57	59	58	59	58	57½	58½
" 3	54	55	57	58	58½	68½	63	57½	58	59	59½	60½	60	59	58½
" 4	50	53	57	58½	58½	59	56½	56½	58	59	56	57	57½	58	59
" 5	53	54	56	57½	58½	56½	56	56	57	58½	54	55½	56½	57	58½
" 6	47	49½	53¾	56	58	49	50	53	55½	58	48¾	50	53	55	57½
" 7	43	45½	50½	54	57	56	51½	50½	53½	57	50	51½	52½	53½	56½
" 8	39½	43	49½	53	56	52½	50½	49½	52½	56	50½	51½	52	52½	55¾
" 9	45	47½	50	52½	55½	54	52	50½	52½	55½	52½	53½	53	53	55
" 10	45½	48½	52	53½	55	54½	52	51½	53	55½	55	55	54½	53½	55
" 11	52	52½	53½	54	55	55	52½	52	54½	55½	58½	57½	55½	55	55
" 12	53	54½	55	55½	55½	54	54½	54½	55	55½	55	55	54½	55	55½
" 13	49½	52	53½	54½	55½	52½	52½	53	54½	55½	52	53½	54	54½	55½
" 14	46	49½	52	53½	55	50½	49½	51½	53	55	52½	52	52	53	55
" 15	44½	48	51	53½	54½	50½	49½	50	52	55	53½	53	51½	52	54½
" 16	46	49½	51½	52½	54	50½	49½	50½	52	54	52½	53	52	52	54
" 17	52	52½	53	53	54	55	53½	53	53¼	54	56½	55½	54	54	54
" 18	48½	51½	53	54	54	51½	51	52	53½	54½	53½	53½	53	53	54½
" 19	46½	49½	52	53	54	52	50	51	52½	54	55	53½	52	53	54
" 20	50½	52½	53	53½	54	50	51½	52	53½	54	50	51½	52	53	54
" 21	43½	47	50	51½	53½	45½	46½	49	51	53½	48½	48½	49	51	53
" 22	45½	47	48½	50	53	45½	47	48	50	52½	45½	47	48	49	52½
" 23	41	45	47	49	52	45	44½	46½	48½	52	47	47	47½	48½	52
" 24	39½	44	46½	48½	51½	42½	43½	46	47½	51½	47	47	47	47½	51
" 25	43	44½	46	47½	50½	46½	46	46	47½	50½	47½	47½	48½	48	50½
" 26	45	46	47	48½	50	46	46½	47	48	50¼	45	46	47	47	50
" 27	42	43	45½	47½	50	42½	43	45	47	50	42	43	45	47	50
" 28	39	41	43	46	49½	41½	42	43½	46	49½	42	44	45	46	49½
" 29	37½	39	42	45	49	40	40	41½	44	49	41	41½	42½	44½	49
" 30	40½	41½	43	44½	48½	41½	42	43	44½	48½	42	42½	45	44½	48
" 31	42	42½	43½	45	48	48½	43	44	45	48	44	44	44½	45½	48
Means	46.1	48.6	50.6	52.2	54.1	50.7	49.8	50.2	51.9	54.1	50.6	51.2	51.4	51.9	54.0

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RECORD OF SOIL TEMPERATURES AT GRAYLING, APRIL, 1889.

Date.	7 A. M.						1 P. M.						7 P. M.						Remarks on Weather.
Depth in inches	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	
April 1	34⅛	32	32	32⅛	33	33⅛	33⅛	36⅛	34½	33⅛	33⅛	33	36⅛	36⅛	36⅛	36	35	33⅛	Light snow.
" 2	30	32	34⅛	34⅛	33½	34⅛	34	40	37	34	33⅛	34	35	37	36	35½	34	33	
" 3	34	34	35	35⅛	35	35	35	38	34	34	34⅛	35	34	35½	34½	34⅛	34½	34½	Light snow.
" 4	30	32⅛	33	33⅛	33⅛	35	40	39⅛	35⅛	34	33⅛	35	37	40	39	37	35⅛	35	
" 5	20	32⅛	33⅛	34⅛	34⅛	35	20	32	33⅛	33⅛	34	35	21	32	33	33½	35⅛	35	Light snow.
" 6	39	31	33	33	33	35	50	44⅛	38	34	34	35	41	44⅛	42	40	36	35	
" 7	32	33	34½	35⅛	35⅛	36	55	51⅛	44⅛	38	36⅛	36	52	49½	47½	45½	40	36	
" 8	44	39	39	39	39	37	57	47⅛	44	40	39	38	52	38	38	39	40	38	Light rain.
" 9	44	43⅛	38	39⅛	40	38	64	58	51⅛	46⅛	41	38	51	63	52	48	44	39	
" 10	39	36	38⅛	40	41	40	65	59	50	44	41⅛	40	49	56	54	49	48½	40	
" 11	69	43	43	45	44⅛	42⅛	60	51½	48⅛	45⅛	43⅛	41⅛	54	49	48½	47	45	41	
" 12	50	61	46½	44	42	42	30	50	48	46	42	42	43	49	49	42½	42	42	
" 13	40	35⅛	38	40	41⅛	42⅛	41⅛	45	43⅛	43⅛	41	42⅛	42	49	45	43	41⅛	42½	
" 14	30	35	37	39	46	42⅛	54	51⅛	47	42⅛	40⅛	42⅛	50	51	49	47	47	42	
" 15	34	34	38	42⅛	43	43⅛	66	48	48	45	42	42⅛	52	54	52	44	43	41½	
" 16	38	37	39	42⅛	42⅛	42⅛	66	59	50⅛	45⅛	44⅛	42⅛	50	54	53	47	44	42	
" 17	42	43	43	45	44	42	62	58	50	47	45	43	58	53	30	47	45	43	
" 18	58	54	50	48	44	43	51	45	46	46	44	43⅛	71	63	55	49⅛	46	44	Rain, first of the season.
" 19	64	58	56	55	50	44	54	52	52	51	50	46	61	58	55	52½	50½	46	
" 20	66	52	55	50⅛	50⅛	46	51	58	55	53⅛	51⅛	46	43	44	46	47	47	47	
" 21	70	66	57⅛	53⅛	49	47	51	60	56	52	47	47	40	45	47½	49½	50	48	
" 22	47	53⅛	50	49⅛	49	48	40	49	50	49	49	47	36	36	40	44	45	47	
" 23	51	50	52⅛	46	45	47	40	45	60	50	46	46	46	50	51	52½	49	56½	
" 24	40	54	44	45	46	47	56	60	53	48⅛	48	46	60	57½	56	53	50	46½	
" 25	50	51⅛	51⅛	50⅛	49⅛	47	50	54⅛	54	51⅛	50	47⅜	43	43½	44	45½	46	47⅛	
" 26	33	43⅛	44	45	46	47⅛	31	43	43⅛	44⅛	45	47	31	39	41½	43	43	46	
" 27	61	63	52⅛	45	44	45⅛	46	58	57	53	49⅛	48	44	44⅛	46	47⅛	48	46½	Light rain.
" 28	50	48⅛	48	47⅛	47⅛	46⅛	49	46	46	46	47	46⅛	44	44	46	46	46	46½	
" 29	43	48⅛	43	43	46	46⅛	22	40	40	42	42	46	34	38	41½	42½	42½	45	
" 30	38	36⅛	38⅛	39⅛	41⅛	44⅛	20	44	42	41⅛	41⅛	44	38	43	42	42½	42⅛	44	
Means	44	43.4	42.6	42.5	42.31	41.8	47.4	48.4	46.4	43.8	42.3	42.	44.9	44.9	45.	44.2	43.3	41.1	

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RECORD OF SOIL TEMPERATURES AT GRAYLING, MAY, 1889.

Date.	7 A. M.						1 P. M.						7 P. M.						Remarks on Weather.
Depth in inches	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	
May 1	34	36	37½	37½	48½	43	42	44	42	42	41	43	40	37	38	40	41	43	
" 2	44	37	38½	40	41	43	55	54	47	48	43	43	41	56	49½	45	45	43	
" 3	45	57	32½	43	43½	43	60	58	52	46	44	43	51	58	52	46	44	43	
" 4	57	54½	53½	49	47	43	50	54	49	45½	46	45	72	61½	53	49	46½	45	
" 5	72	50	53½	49	46½	45	70	60	59½	53	50½	45	64	48	48½	48½	48	46	
" 6	50	48	57	53½	50	45	64	59	48	48½	48½	46	60	67	55	52½	50	47	
" 7	67	53	60	57½	54	47½	68	63	53	53	53	48	70	65	63	60	56	47	
" 8	83	69½	61	56	54½	48	72	65	63	60	56	48	72	69	61	56	56	43	
" 9	85	72½	65	60	56½	51	75	70	64	60	58½	53	84	68	68	63	59	53	
" 10	80	63	65½	62½	54	53	73	69	62½	62½	62	55	85	75	70	65	63	55	
" 11	81	64	64	64	62	55	60	70	70	64	64	57	70	64	64	64	64	55	
" 12	48	64	56	65	54	57	54	55	58½	59	64	57	65	64	63	62	60	56	
" 13	49	43	43	55½	57½	56	69	63	59	57	57½	56	61	60	59	58	57½	55½	
" 14	54	42	54	55	56	55	55	64	50	59	57	56	46	54	55	56	56	56	
" 15	44	53	54	55	55	55	43	64	64	51	53	55	43	44	44	49	50	54	
" 16	43	35	46	48	50	54	60	53	49	49	49	54	63	56	55	53	53	53	Heavy rain.
" 17	70	53	55	54	54	53½	80	68	63	58	57½	53	75	67	64	61	58	53	
" 18	75	59	50	58	58	54	75	69½	69	67	60	54½	68	69	69	67	65	55	Heavy rain.
" 19	63	61	61½	61	61	56	68	66	64	62	61	57	54	54	55	57	58	57½	
" 20	54	44	54	57	57	57	50	61	60	58	57	56½	41	53½	56	57½	58	56	Misty.
" 21	34	45	48½	51	53	55	44	47	49	51	53	55½	40	47	49	50	52	54	Light rain.
" 22	40	48	45½	49	50	54	53	56	51	49	49	52	49	57	49	49	51	53	
" 23	44	48	48	49	50	53	45	47	48	48	49	52	42	47	48	49	51	42	
" 24	45	31½	42	44	47	51	58	62	54	49	47½	50	42	53	54	54	52½	52	Mist and rain.
" 25	58	52	52	49	47½	50	64	63	62	49	49	50½	46	40	40	48	49	50	
" 26	64	63	58	53	51	50	64	63	58	53½	51	50	59	58	57	55	53	50	
" 27	56	49½	53	52½	52½	51	48	60	50½	51½	51½	51	38	45	48	48	49½	50½	
" 28	34	38	41	44½	46½	51½	40	42	42	43	45	49½	40	44	45½	46	48	58½	Heavy rain.
" 29	35	37	40	43	44	48½	46	49	48½	45	45	48	44	41	47	46	46	48	
" 30	43	42	43	44	45	48	43	43½	44	44	44	47	33	40	40	40	43	47	Heavy rain.
" 31	41	39	40	41½	43	46½	45	45	43½	43	43	46	44	44	44	44	44	46½	All day rain.
Means	54.6	50.	51.	51.6	51.3	50.8	58.5	58 2	54.7	52.5	51.9	50.9	54.9	55.	53.7	52.8	52.5	50.6	

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RECORD OF SOIL TEMPERATURES AT GRAYLING, JUNE, 1889.

Date.	7 A. M.						1 P. M.						7 P. M.						Remarks on Weather.
Depth in inches	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	
June 1	43	43	43	44	44⅓	46	49	43	44	45	46⅓	41	49	40	48	47	46	57	Heavy rain.
" 2	48	48	48	46	46	57	48	46	46	46	46	47	48	39	47	48	46	57	Rain.
" 3	48	46	46	46	46½	47	45	51½	49	49	47	47	47	49	49	49	47½	48	Rain.
" 4	43	46½	46½	47	47½	47⅜	51	52	50	48½	47⅜	47½	46	48	48	49½	48⅜	48	Rain.
" 5	47	46⅜	47	47	47	48	59	57⅓	53⅜	49½	48⅓	48	51	54	55	56½	51½	48	
" 6	55	46⅓	47	47	48	49	72	61	61	54	50	48	60	63	61	57⅓	55	49	
" 7	60	55	55⅓	54½	52	50	68	61	57⅓	55⅓	53	51	60	59	59	55	50½	49	Rain.
" 8	56	53	54	55	54½	52	56	55½	55	54	53	52	51	54	55	54	53	57	
" 9	47	49	50	51	52	52	50	50	50	50	51	51	50	51	51	51	51	51	
" 10	48	51	51	51	50	51⅛	59	56⅛	54⅜	52⅜	51⅜	51⅜	57	.....	56	55	54	51⅜	
" 11	55	53	52⅜	53½	51½	52	66	63	59	55⅛	53½	51⅛	61	68⅛	58⅜	57	55⅜	52⅜	
" 12	66	51	53½	53	53⅓	52½	71	76	63	57	54½	52	67	51	57	51½	53	53	
" 13	57	58	58	59	58½	54	63	70	65	60	58	55	64	66	64	63	61	55	
" 14	66	55	55	57	56	56	84	75	62	62	58½	56	56	49	72	72	70	63	
" 15	69	63	63	62⅜	62	58½	75	79	72	66½	63	58	72	74	73	69⅛	65	58	
" 16	64	63	63⅜	63	63½	55	65	65	64	63½	62	59⅜	66	64	62⅜	62⅜	61⅜	59	
" 17	61	58	58	59½	60	59	70	75	68	63½	60½	59½	65	71	70	68	69	59	
" 18	55	57	59	61	61	59½	76	73	68	64	61½	59⅜	73	69	68	65½	63½	59	
" 19	70	65	65½	64½	63	60	75	78	73	68	65	60	66	68	69	68	66	60	
" 20	63	58	59	61⅜	62	60½	75	65	66	63	62	60	65	64	64	62	62	60	
" 21	55	61	61	61½	62	60⅜	54	66	60	61	61	61	50	57	58	59	60	59½	
" 22	45	55½	55	56½	59½	59	50	58	57	56	57	58	49	53	58	59	55	57	
" 23	46	49	50	52½	54	57	66	66	60½	56	55	57	44	51	52	56	55	57	
" 24	54	51½	52	56⅛	55⅜	57	73	71⅛	63	58⅛	56⅜	56⅛	66	67	66	63½	60	56	
" 25	63	56	55	58½	58½	57	75	73	65½	61½	59⅜	57	72	69	68	65	63	57	
" 26	71	61½	61⅜	61	61	59	80	70	73	68⅜	63	60½	59⅜	69	69	66	64	61	
" 27	60	61½	61½	61½	61½	60	75	76½	76	71½	65½	63	60	69	69	65	63	60	Rain.
" 28	58	60	60	63	63½	60	80	81½	72	66½	63	60⅜	75	69	69	65	63	60	
" 29	73	63½	63⅜	63½	64⅛	65	86	83	74½	69	65	62	75	78	77	75	73	70	
" 30	73	60	60	63	63½	65	86	81⅛	75	70	68½	64½	75	66	67	66	67	63	
Means	57.3	54.8	55.5	56.	56.1	55.5	66.7	66.	61.9	58.8	56.9	55.2	59.9	58.3	61.3	60.	58.4	56.5	

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RECORD OF SOIL TEMPERATURES AT GRAYLING, JULY, 1889.

Date.	7 A. M.						1 P. M.						7 P. M.						Remarks on Weather.
Depth in inches	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	Open air.	3	6	9	12	14	
July 1	74	57	68	68	68	65	87	85⅛	78	72	69	65	86	80	79	74	73	66⅛	
" 2	76	83	81⅛	77	74	66⅛	88⅛	86	79⅛	74	71	66	84	83	81⅛	77	74	66⅛	
" 3	76	72	72⅛	72⅛	72⅛	67	60	70	71	71⅛	72	67⅛	60	65	66	68	69	65	Heavy rain.
" 4	56	60	61	61	63⅛	67	77	75	70	66	65	67	66	66	69	65	65	66	
" 5	66	55	60	62⅛	63	65	78	80	73	68	64	65	73	63	60	55⅛	66⅛	65	
" 6	75	80	72	71	68	65	76	76	76	76	70	70	75	68	68	68	69	66	
" 7	77	68	68	68	68	66	88	86	70	70	69	67	75	66	66	67	69	66⅛	
" 8	80	70	70	70	69	67⅛	90	88	80	70	74	67⅛	86	83	81⅛	79	77	68	
" 9	80	73	73	73	73	69	91	89	83	77	71	69	86	80	81	74	71	70	
" 10	82	73	73⅛	73	73	70	86	75	75	74	73	69	60	63	65	67	68	69	Heavy rain.
" 11	60	77	78	72	69	68	76	52	50	55	68	68	60	50	50	56	68	68	
" 12	70	68	69	70	70	68	83	85	78	73	71	69	76	70	70	75	76	69	
" 13	71	66	70	74	72	69	76	86	78	74	72	69	60	76	71	70	74	69	
" 14	58	63	65	66	68	67	75	80	73	68	67	67	66	70	69	67	66	67	
" 15	63	62	64	66	67	67	83	72	72	69	67	67	73	63	66	67	67	67	Light rain.
" 16	80	75	71	69	68	67	83	75	71	69	68	67	85	76	74	71⅛	70	67	
" 17	76	64	65	67	68	67	80	75	69	68	68	67	73	72	72	70	70	67	
" 18	74	68	68	68	68	67⅛	85	85	71⅛	70	69	67⅛	71	66	68	68	69	67	
" 19	55	60	68	69	69	67⅛	85	80	75	71	69	67⅛	75	78	76	74	71	67	
" 20	70	70	70	72	72	67	65	75	71	72	70⅛	69	60	72	72	75	76	68	
" 21	54	64	64	65	68	68	74	81	74	69	68	68	66	70	70	78	68	68	
" 22	60	63	65	68	68	68	82	80	78	73⅛	70	68	65	65	67	68	69⅛	67⅛	
" 23	65	67	68	69	68	67	75	75	71	69	68	67	70	73	72	71	70	67	
" 24	55	60	62	65⅛	65⅛	67⅛	74	80	79	71⅛	69	67	65	73	61	64⅛	66⅛	66⅛	
" 25	56	57	61	64⅛	66⅛	66⅛	73	77	71	69	67	66⅛	65	69	69	67	66	66⅛	
" 26	60	60	63	65	66	67	75	80	76	69	67	67	67	69	69	68	69	67	
" 27	66	62	64	66	67	67	83	82	80	72	67⅛	67	75	72	69	67	67	67	
" 28	75	63	66	67	67	67	83	72	70	69	68	67	73	70	69	69	66	67	Heavy rain.
" 29	73	63	66	67	67	67	83	73	71	69	68	67	85	75	74	71	70	67	Clouds and rain.
" 30	70	63	65	67	67	66	80	76	74	71⅛	70	66	73	72	72	70	70	70	
" 31	64	56	56	55	60	64	78	72	70	64	63	64	68	69	68	68	67	63	
Means	68.3	65.9	67.3	68.	68.	67.1	79.8	78.1	73.5	70.1	68.9	67.3	71.7	71.4	69.8	69.3	69.6	67.1	

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RECORD OF SOIL TEMPERATURES AT GRAYLING, AUGUST, 1889.

Date.	7 A. M.						1 P. M.						7 P. M.						Remarks on Weather.
Depth in inches	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	
August 1	63	56	58	60	64	64	78	72	70	64	63½	64	68	69	68	67	63	64	
" 2	65	60	63	63	63	64	75	81	74	68	65	64	65	73	72	68	65	64	
" 3	65	61	61	63	64	64	73	78	72	68	65	65	61	72	71	69	67	64	Rain.
" 4	60	50	50	63	65	64	73	78	68	65	64	64	65	73	72	70	67	64	
" 5	59	56½	60	63	65	64½	71	78	70	75	64	64	73	75	73	69	66	64	
" 6	59	56	60	63	65	64	71	78	70	65	64	64	73	75	73	69	66	64	
" 7	60	55	61	64	65	64	80	78	67	67	65	65	65	76	73	70	67	65	
" 8	65	64	65½	65	66	64½	68	65	65	65	65	64	69	65	65	65	65	64	Rain.
" 9	76	65	65	65	65	64	70	79	71½	67	65	64	65	74	74	69	68	64	
" 10	62	60	63	64	66	65	73	81	72	67	66	65	57	74	72	70	67	64	
" 11	55	56	56	59	65	64	71	80	71½	65	64	65	66	76	73	69	66	64	
" 12	55	58	60	65	64	64	74	75	67	67½	64	64	73	75	73	68	66	64	
" 13	60	62	63	65½	65	64	63	65	63	63	64	64	67	62	62	63	64	64	Heavy rain.
" 14	66	60	60	63	63	64	63	65	65	63	63	63	66	64	65	63	63	64	Heavy rain.
" 15	54	55	65½	58½	59	63½	66	70	64½	61½	60½	63	63	66½	65	64	62½	62	
" 16	65	54	54	59	60	64	64	73	67	63	61	63	59	66	65	63	69	62	
" 17	54	55	55	54	59	63	73	76	67	67	64	63	68	70	68	66	64	62	
" 18	64	59	60	63½	63½	63	75	71	68	65	63	62	68	68	67	66	64½	62	
" 19	70	64	64	64	64	63	83	80	73	68	65½	63	70	76	70	67	65	63	
" 20	74	67	67	68	67½	64	84	76	73	70	68	64	80	70	70	69	66	64	
" 21	66	69	69	69	68½	65	71	70	70	69	68	65	70	70	70	68	68	65	
" 22	65	61	63	65	66	65	77	72	72	68	68	65	71	74	72	71	68	65	
" 23	64	63	64	66	66	65	71	73	68	64	65	65	62	72	69	69½	66	65	
" 24	57	68	64	65	65	64½	87	79	72	67½	65	64	73	76	73	70	67	64	
" 25	69	65	66	67	67	65	77	72	70	67	67	65	74	74	72	69	68	64½	
" 26	66	65	66	67	67	65	77	72	70	75	66	65	74	74	72	69	68	64	
" 27	66	65	66	66½	67	65	88	78	72	67	66	65	83	70	68	68	68	65	
" 28	67	65	65	67	68	65	87	77	68	67	67	66	78	72	70	67	67	65	
" 29	77	68	68	69	69	64	74	81	71	69	66	64	80	80	77	73	71	66	
" 30	69	69	70	70	70	66½	83	79	76	73½	70	66½	75	75	76	68	68	67	
" 31	64	63	65	68	68	67	86	78	72	72	68	67	76	78	75	72	69	67	
Means	63.9	61.1	62.5	64.3	65.1	64.4	75.0	75.2	69 7	67.1	65.1	64.3	69.6	72.1	70.5	68.0	66.4	64.2	

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RECORD OF SOIL TEMPERATURES AT GRAYLING, SEPTEMBER, 1889.

Date.	7 A. M.						1 P. M.						7 P. M.						Remarks on Weather.
Depth in inches	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	
September 1	64	63	64	66½	67½	66½	84	79	79	73½	67	66	74	76	74	70	68	66½	
" 2	62	63	64	67	68	66½	85	71½	71½	71½	67	66½	70	75	71	69	68	66	
" 3	70	68	68	68	68	66	76	76	71	69	68	66	70	73	69	68	68	66	
" 4	70	66	66	67½	68	66	78	73	72	68	68	66	70	69	69	68	68	66	
" 5	66	63	64	65	66½	65	55	63	63	63	66	65	60	63	64	65	65	65	Heavy rain.
" 6	59	55	58	58	63	64	73	73	66	63	63	64½	68	68	68	66	64	64	Frost.
" 7	64	58	59	62½	62	63½	70	73	67	63	62	63	58	58	60	63	63½	63½	
" 8	58	58	60	63	63½	63	.....	79	73	67	64½	63½	74	74½	73	69½	67	63	
" 9	60	62	63	63½	64	64	66	76½	70	65	64½	64	60	71	70	66	63	63	
" 10	64	64	64	65	66	64	88	74	70	67	65½	64	74	72	71½	69	67	64	
" 11	64	63½	63	63	66	65	85	77	72	67	66	65	77	76	74	70	68	64	
" 12	63	62	65½	66½	67	65	81	78	72	70	67	65	80	72	70	69	67	65	
" 13	60	64	64	66	66	65	73	79	73	68	67	65	74	78	78	74	71	65	
" 14	64	63	67	67½	66	65	85	75	70	67½	66½	65	75	75	78	70	65	65	
" 15	74	67	67	67½	68	65	74	75	70	67½	67½	65	65	62	63	63	65	66	
" 16	50	52	52	55½	59	63	50	55	55	56	58	65	50	56	56	56	59	63	
" 17	40	54	56	54	56	60	50	55	55½	56	58	62	50	55	55	56½	58	62	
" 18	40	49	51	54	56½	60	54	50	56	56	56	60	50	55	55	55	55	62	
" 19	45	45	48	51	53	59	57	60	55	55	53½	59½	50	53	53	53	55	59½	
" 20	50	51½	52½	53½	54	55½	41	56	56	55	54½	55½	41	49	49	49	54	57	
" 21	41	44	47	49	51	57	49	55	55	52	51	56½	46	50	52	51	51	56	
" 22	44	44	47	49	49	57	60	64	56	51½	50	55	59	64	56	51	50	54½	
" 23	55	51	52	53	53	55	74	67	61	56	54	55	65	64	63	57	56	55	
" 24	45	52	53½	54	55	55	78	73	64	59	66	56½	68	67	66	63	56	56	
" 25	56	57	57	58	58½	57	60	56	57	57	58	57	53	57	57	57½	57	57	Rainy.
" 26	43	47	50	54	54	57	47	52	51	52	55	56	42	50	50	50	53	56	
" 27	42	44½	47	48	55	56	44	49	49	44	48	55	42	66	57	57	58	53	Rain.
" 28	34	39	41	44	46	53	56	55	51	48	57	53	54	55	54	53	49	53	
" 29	57	45	43	43	48	52	69	60	57	57	51	52	62	58	55	53	51	52	
" 30	55	53	52	51½	56½	52½	57	53	53	53½	52½	52½	57	50	50	51	52	52½	
Means	55.3	55.5	56.8	58.3	60.1	60.7	66.2	66.1	63.0	60.8	60.4	60.8	61.3	63.7	62.5	61.1	60.5	60.7	

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RECORD OF SOIL TEMPERATURES AT GRAYLING, OCTOBER, 1889.

Date.	7 A. M.						1 P. M.						7 P. M.						Remarks on Weather.
Depth in inches	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	Open air.	3	6	9	12	24	
October 1	50	52	52	52	52	53	45	49	49	55	51	53	40	55	45	47	46	53	Rain.
" 2	40	43	43	47	46	53	53	57½	57½	53	49½	52½	44	49	49	48	48	52½	
" 3	53	42	44	49	50	52	52	58	58	50	48	52	44	50	49	49	48	53	Rain.
" 4	44	45	46½	47	48	51½	56	48	44	46	48	51	56	43½	43	45	47	50½	
" 5	44	45	45	47	48	51½	55	48	44	46	48	51	50	40	43	44	47	50½	
" 6	38	37	38	42	48½	50	37	42	41½	42½	44	49¼	37	47	42	42	44	49	
" 7	37	36	38	41	43	48	53	36	38	41½	44½	47½	50	44	43	40	42	47	
" 8	37	38	38	41½	43	48	53	48½	44	41½	42½	47	50	48	44	43	42	47	Rain.
" 9	44	42	43	43	44	47	60	58½	51	47	45½	47	54	49	48	47	46	47	
" 10	33	44	43	44½	46	48	54	53	49	46	45	48	54	44	44	44	45	48	
" 11	47	44	45	46½	47	48	64	60	54½	52	47	48	64	60	54	54	47	48	
" 12	45	45	47½	48	48½	48	57	56	56	53	50	48	45	46	47	47	48	48	
" 13	45	45½	47½	48	48½	48	45	49	49	48	48	48	48	42	44	45	45	48½	
" 14	35	35	38	43	44	48	53	47	47	43	43½	47½	40	40	40	42½	44	47	
" 15	40	37	40	42	44	47	62	57	49	45½	44	47	50	44	44	48	48	47	Snow.
" 16	62	38	41	43½	45	47½	55	48	46½	45	45	47	48	46	46	48	48	47	
" 17	48	44	45	46	46	47	55	56	51	46	46	47	48	46	47	47	48	47	
" 18	34	46½	43	43	44	47½	54	54	48	45½	44½	47½	50	50	48	45	44	47	
" 19	41	37	40	43	43	47	67	47	47	43	43½	47	49	48	48	47	43	47	
" 20	37	40	41	42½	43½	47	43	46½	44	43	43	46½	40	43	43	43	43	46½	
" 21	29	37	39	41	43	46	39	45	43	41	43	46	39	42	42	43	43	46	
" 22	27	37	39	40	41½	45	33	39	38	40	42	45	33	39	39	40	43	45	
" 23	19	30	36½	31½	32	44	41	44	37	37	39	44	41	37	37	39	39	44	Rain.
" 24	35	34	36	37½	39	43	41	41	41	38	39	43	41	40	40	38	37	43	
" 25	39	39	39	39	39	43	42	43	41	39	39½	42	41	39	40	39	39	42½	
" 26	36	37	39	39½	40	42	43	39	39	39	39	43	40	38	38	38	39	42	.
" 27	34	36	39	39	39	42	35	37	38	39	39	42	40	37	38	39	39	43	
" 28	33	35	35½	36½	39	42	47	47	41½	36	39	42	40	44	44	38	38	42	Mist.
" 29	22	35	35	38	39	42	43	36	39	39	39	42	40	39	39	38	39	42	
" 30	40	38	38½	38½	39	42	44	40	40	40	39	42	40	39	39	39	39	42	
" 31	40	38	38	38	39	42	44	40	40	44	39	42	42	37	38	39	39	41	Light rain.
Means	39.1	39.8	40.9	42.6	43.6	46.8	49.2	47.6	45.2	44.1	43.8	46.6	45.1	44.0	43.4	43.4	43.4	46.5	

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COMPARATIVE SUMMARY OF SOIL TEMPERATURES OF 1888 AND 1889 AT AGRICULTURAL COLLEGE, FOR THE MONTHS OF MAY TO SEPTEMBER, INCLUSIVE.

Depth in inches..	3.			6.			9.			12.			24.		
Months, etc.	1888.	1889.	Difference.*	1888.	1889.	Difference.	1888.	1889.	Difference.	1888.	1889.	Difference.	1888.	1889.	Difference.
May:															
7 A. M...	50°.4	54°.5	-4°.1	51°.3	55°.4	-4°.1	52°.1	56°.6	-4°.5	52°.2	56°.9	-4°.7	50°.2	55°.3	-5°.1
1 P. M...	60 .2	64 .4	-4 .2	55 .8	60 .4	-4 .6	53 .4	57 .7	-4 .3	52 .2	56 .6	-4 .4	50 .4	55 .4	-5 .0
7 P. M...	57 .7	61 .0	-3 .3	57 .3	61 .0	-3 .7	55 .5	59 .6	-4 .1	53 .8	57 .9	-4 .1	50 .4	55 .5	-5 .1
Means.....	56°.1	60°.0	-3°.9	54°.8	58°.9	-4°.1	53°.7	58°.0	-4°.3	52°.7	57°.1	-4°.4	50°.3	55°.4	-5°.1
June:															
7 A. M...	64°.7	59°.0	5°.7	65°.2	59°.7	5°.5	65°.9	60°.2	5°.7	65°.7	60°.1	5°.6	62°.7	55°.3	4°.4
1 P. M...	77 .6	67 .4	10 .2	71 .4	63 .7	7 .7	68 .0	61 .4	6 .6	65 .8	60 .1	5 .7	62 .8	58 .4	4 .4
7 P. M...	74 .3	64 .3	10 .0	71 .6	64 .1	7 .5	70 .0	63 .0	7 .0	67 .7	61 .4	6 .3	62 .7	58 .4	4 .3
Means.....	71°.5	63°.6	7°.9	69°.4	62°.5	6°.9	68°.0	61°.5	6°.5	66°.4	60°.5	5°.9	62°.7	58°.4	4°.4
July:															
7 A. M...	68°.6	68.°3	0°.3	69°.9	69°.4	0°.5	70°.8	70°.6	0°.2	70°.7	70°.8	-0°.1	68°.1	68°.8	-0°.7
1 P. M...	80 .7	79 .3	1 .4	75 .3	74 .7	.6	72 .4	72 .0	.4	70 .5	70 .7	- .2	68 .1	68 .8	- .7
7 P. M...	76 .7	75 .5	1 .2	75 .9	75 .3	.6	74 .3	74 .0	.3	72 .0	72 .0	.0	67 .6	68 .6	-1 .0
Means.....	75°.3	74°.4	0°.9	73°.7	73°.1	0°.6	72°.5	72°.2	0°.3	71°.1	71°.2	-0°.1	67°.9	68°.7	-0°.8
August:															
7 A. M...	67°.4	66°.8	0°.6	68°.6	68°.2	0°.4	70°.0	69°.7	0°.3	70°.4	70°.1	0°.3	68°.5	68°.2	0°.3
1 P. M...	77 .6	75 .8	1 .8	74 .3	73 .3	1 .0	71 .6	70 .6	1 .0	70 .3	69 .8	.5	68 5	68 .4	.1
7 P. M...	74 .8	74 .9	- .1	74 .6	74 .6	.0	72 .7	72 .7	.0	71 .3	70 .8	.5	68 .4	68 .1	.3
Means.....	73°.3	72°.5	0°.8	72°.5	72°.0	0°.5	71°.4	71°.0	0°.4	70°.7	70°.2	0°.5	68°.5	68°.2	0°.3
Sept.:															
7 A. M...	58°.5	60°.3	-1°.8	60°.9	62°.5	-1°.6	62°.5	64°.4	-1°.9	63°.9	65°.6	-1°.7	64°.1	65°.6	-1°.5
1 P. M...	66 .2	68 .0	-1 .8	63 .6	65 .3	-1 .7	63 .1	64 .6	-1 .5	63 .3	65 .2	-1 .9	64 .2	65 .7	-1 .5
7 P. M...	65 .2	66 .2	-1 .0	65 .4	66 .4	-1 .0	64 .7	66 .0	-1 .3	64 .0	65 .9	-1 .9	64 .1	65 .3	-1 .2
Means.....	63°.3	64°.8	-1°.5	63°.3	64°.7	-1°.4	63°.4	65°.0	-1°.6	63°.7	65°.6	-1°.9	64°.1	65°.5	-1°.4

* Differences with a minus sign (-) before them indicate the excess of the monthly mean temperature of 1889 over the corresponding mean temperature of 1888. Those without the minus sign indicate the reverse.

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COMPARATIVE SUMMARY OF SOIL TEMPERATURES OF 1888 AND 1889 AT GRAYLING FOR THE MONTHS OF JUNE TO SEPTEMBER, INCLUSIVE.

Depth in inches	3.			6.			9.			12.			24.		
Months, etc.	1888.	1889.	Difference.*	1888.	1889.	Difference.	1888.	1889.	Difference.	1888.	1889.	Difference.	1888.	1889.	Difference.
June:															
7 A. M...	61°.3	54°.8	6°.5	62°.9	55°.5	7°.4	63°.7	56°.0	7°.7	63°.5	56°.1	7°.4	61°.0	55°.5	5°.5
1 P. M...	70 .7	66 .0	4 .7	67 .9	65 .2	2 .7	65 .2	58 .8	6 .4	63 .5	56 .9	6 .6	61 .3	55 .2	6 .1
7 P. M...	72 .8	58 .3	14 .5	71 .0	61 .3	9 .7	68 .5	60 .0	8 .5	65 .3	58 .4	6 .9	61 .0	56 .5	4 .5
Means.....	68°.3	59°.7	8°.6	67°.3	60°.7	6°.6	65°.8	58°.3	7°.5	64°.1	57°.1	7°.0	61°.1	55°.7	6°.3
July:															
7 A. M...	63°.9	65°.9	-2°.0	66°.5	67°.3	-0°.8	68°.3	68°.0	0°.3	68°.3	68°.0	0°.3	66°.8	67°.1	-0°.3
1 P. M...	75 .5	78 .1	-2 .6	71 .1	73 .5	-2 .4	69 .0	70 .1	-1 .1	68 .0	68 .9	- .9	66 .8	67 .3	- .5
7 P. M...	75 .5	71 .4	4 .1	74 .1	69 .8	4 .3	71 .8	69 .3	2 .5	69 .7	69 .6	.1	66 .6	67 .1	- .5
Means.....	71°.6	71°.8	-0°.2	70°.6	70°.2	0°.4	69°.7	69°.1	0°.6	68°.7	68°.8	-0°.1	66°.7	67°.1	-0°.4
August:															
7 A. M...	63°.0	61°.1	1°.9	63°.9	62°.5	1°.4	65°.3	64°.3	1°.0	65°.8	65°.1	0°.7	65°.3	64°.4	0°.9
1 P. M...	73 .8	75 .2	-1 .4	68 .5	69 .7	-1 .2	66 .5	67 .1	- .6	65 .6	65 .1	.5	65 .0	64 .3	.7
7 P. M...	71 .5	72 .1	- .6	70 .8	70 .5	.3	69 .2	68 .0	1 .2	67 .4	66 .4	1 .0	64 .5	64 .2	.3
Means.....	69°.4	69°.4	0°.0	67°.7	67°.5	0°.2	67°.0	66°.5	0°.5	66°.2	65°.5	0°.7	65°.0	64°.3	0°.7
Sept.:															
7 A. M...	56°.6	55°.5	1°.1	56°.4	56°.8	-0°.4	57°.2	58°.3	-1°.1	58°.1	60°.1	-2°.0	59°.4	60°.7	-1°.3
1 P. M...	61 .4	66 .1	-4 .7	60 .2	63 .0	-2 .8	59 .0	60 .8	-1 .8	58 .9	60 .4	-1 .5	59 .3	60 .8	-1 .5
7 P. M...	60 .1	63 .7	-3 .6	57 .7	62 .5	-4 .8	58 .3	61 .1	-2 .8	58 .3	60 .5	-2 .2	59 .3	60 .7	-1 .4
Means.....	59°.4	61°.8	-2°.4	58°.1	60°.8	-2°.7	58°.2	60°.1	-1°.9	58°.4	60°.3	-1°.9	59°.3	60°.7	-1°.4

* Differences with a minus sign (-) before them indicate the excess of the monthly mean temperature of 1889 over the corresponding mean temperature of 1888. Those without the minus sign indicate the reverse.

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COMPARATIVE SUMMARY OF SOIL TEMPERATURES AT AGRICULTURAL COLLEGE AND AT GRAYLING, FOR THE MONTHS OF APRIL TO OCTOBER INCLUSIVE, 1889.

Depth in inches..	3.			6.			9.			12.			24.		
Months, etc.	Agr'l College.	Grayling.	Difference.	Agr'l College.	Grayling.	Difference.	Agr'l College.	Grayling.	Difference.	Agr'l College.	Grayling.	Difference.	Agr'l College.	Grayling.	Difference.
April:															
7 A. M...	43°.7	43°.4	0°.3	44°.7	42°.6	2°.1	45°.7	42°.5	3°.2	46°.0	42°.3	3°.7	44°.9	41°.8	3°.1
1 P. M...	52 .6	48 .4	4 .2	49 .1	46 .4	2 .7	46 .6	43 .8	2 .8	45 .8	42 .3	3 .5	44 .8	42 .0	2 .8
7 P. M...	49 .9	44 .9	5 .0	50 .0	45 .0	5 .0	48 .7	44 .2	4 .5	46 .8	43 .3	3 .5	44 .6	41 .1	3 .5
Means.....	48°.7	45°.6	3°.1	47°.9	44°.7	3°.2	47°.0	43°.5	3°.5	46°.2	42°.6	3°.6	44°.8	41°.6	3°.2
May:															
7 A. M...	54°.5	50°.0	4°.5	55°.4	51°.0	4°.4	56°.6	51°.6	5°.0	56°.9	51°.3	5°.6	55°.3	50°.8	4°.5
1 P. M...	64 .4	58 .2	6 .2	60 .4	54 .7	5 .7	57 .7	52 .5	5 .2	56 .6	51 .9	4 .7	55 .4	50 .9	4 .5
7 P. M...	61 .0	55 .0	6 .0	61 .0	53 .7	7 .3	59 .6	52 .8	6 .8	57 .9	52 .5	5 .4	55 .5	50 .6	4 .9
Means.....	60°.0	54°.4	5°.6	58°.9	53°.1	5°.8	58°.0	52°.3	5°.7	57°.1	51°.9	5°.2	55°.4	50°.8	4°.6
June:															
7 A. M...	59°.0	54°.8	4°.2	59°.7	55°.5	4°.2	60°.2	56°.0	4°.2	60°.1	56°.1	4°.0	58°.3	55°.5	2°.8
1 P. M...	67 .4	66 .0	1 .4	64 .1	61 .9	2 .2	61 .4	58 .8	2 .6	60 .1	56 .9	3 .2	58 .4	55 .2	3 .2
7 P. M...	64 .8	58 .8	6 .0	64 .1	61 .3	2 .8	63 .0	60 .0	3 .0	61 .4	58 .4	3 .0	58 .4	56 .5	1 .9
Means.....	63°.6	59°.7	3°.9	62°.6	59°.6	3°.0	61°.5	58°.3	3°.2	60°.5	57°.1	3°.4	58°.4	55°.7	2°.7
July:															
7 A. M...	68°.3	65°.9	2°.4	69°.4	67°.3	2°.1	70°.6	68°.0	2°.6	70°.8	68°.0	2°.8	68°.8	67°.1	1°.7
1 P. M...	79 .3	78 .1	1 .2	74 .7	73 .5	1 .2	72 .0	70 .1	1 .9	70 .7	70 .1	.6	68 .8	67 .3	1 .5
7 P. M..	75 .5	71 .4	4 .1	75 .3	69 .8	5 .5	74 .0	69 .3	4 .7	73 .0	69 .3	2 .7	68 .6	67 .1	1 .5
Means.....	74°.4	71°.8	2°.6	73°.1	70°.2	2°.9	72°.2	69°.1	3°.1	71°.2	69°.1	2°.1	68°.7	67°.2	1°.5
August:															
7 A. M...	66°.8	61°.1	5°.7	68°.2	62°.5	5°.7	69°.7	64°.3	5°.4	70°.1	65°.1	5°.0	68°.2	64°.4	3°.8
1 P. M...	75 .8	75 .2	.6	73 .3	69 .7	3 .6	70 .6	67 .1	3 .5	69 .8	65 .1	4 .7	68 .4	64 .3	4 .1
7 P. M...	74 .9	72 .1	2 .8	74 .6	70 .5	4 .1	72 .7	68 .0	4 .7	70 .8	66 .4	4 .4	68 .1	64 .2	3 .9
Means.....	72°.5	69°.4	3°.1	72°.0	67°.5	4°.5	71°.0	66°.5	4°.5	70°.2	65°.5	4°.7	68°.2	64°.3	3°.9
Sept.:															
7 A. M...	60°.3	55°.5	4°.8	62°.5	56°.8	5°.7	64°.4	58°.3	6°.1	65°.6	60°.1	5°.5	65°.6	60°.7	4°.9
1 P. M...	68 .0	66 .1	1 .9	65 .3	63 .0	2 .3	64 .6	60 .8	3 .8	65 .2	60 .4	4 .8	65 .7	60 .8	4 .9
7 P. M...	66 .2	63 .7	2 .5	66 .4	62 .5	3 .9	66 .0	61 .1	4 .9	65 .9	60 .5	5 .4	65 .3	60 .7	4 .6
Means.....	64°.8	61°.8	3°.0	64°.7	60°.8	3°.9	65°.0	60°.1	4°.9	65°.6	60°.3	5°.3	65°.5	60°.7	4°.8
October:															
7 A. M...	46°.1	39°.8	6°.3	48°.6	40°.9	7°.7	50°.6	42°.6	8°.0	52°.2	43°.6	8°.6	54°.1	46°.8	7°.3
1 P. M..	50 .7	47 .6	3 .1	49 .8	45 .2	4 .6	50 .2	44 .1	6 .1	51 .9	43 .8	8 .1	54 .1	46 .6	7 .5
7 P. M...	50 .6	44 .0	6 .6	51 .2	43 .4	7 .8	51 .4	43 .4	8 .0	51 .9	43 .4	8 .5	54 .0	46 .5	7 .5
Means.....	49°.1	43°.8	5°.3	49°.9	43°.2	6°.7	50°.7	43°.4	7°.3	52°.0	43°.6	8°.4	54°.1	46°.6	7°.5

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IV.—SUNSHINE TEMPERATURE.

The meteorologist seeks to find the temperature of the air in the shade, removed as far as possible from the direct influence of the sun's rays, and for this purpose much ingenuity is exercised to estimate as far as possible the direct heat rays of the sun. For the meteorologist such a method is very valuable. We have so long dwelt upon this shade temperature as the most important datum in the thermometry of physical existence that we forget the more important fact of the sunshine temperature. For the living thing, whether animal or vegetable, the sunshine temperature is even more important than that in the shade. Vigor in living is the child of the sunshine. "Walk in the light" is the condition of excellence alike in the physical and in the moral world. In the vegetable kingdom the importance of direct sunlight is fully recognized. Other things being equal, the vigor and development of the plant is directly proportionate to the amount and intensity of the sunlight. Our grains, our fruits, and all our farm products are packed full of sunshine. No shade temperature can compare in importance with this sunshine temperature. Why, then, should observations by the thermometer be limited to the shade? Can the conditions of vegetable growth be properly studied without a full and complete study of the thermometry and psychrometry of the sunshine as well as the shade?

Some observations looking in this direction have been taken during the year, but they are imperfect and unsatisfactory as all such observations must be when better methods and more complete results are readily obtainable. These observations relate to the maximum and minimum temperatures taken in open air and with full exposure to the sun. Two sun thermometers in vacuum were used, one with bright or mercurial bulb and the other blackened by coating of lampblack. These were actinometers rather than thermometers. Two other self-recording thermometers with bulbs of black glass were used, one at the College, the other at Grayling. All of these thermometers were placed ten inches above the ground, and results read off daily. A minimum thermometer, placed four inches above the ground, was used at each station from April to November.

No discussion of the results of these observations is attempted, A fuller set of observations of the temperature of wet and dry bulb thermometers in the sunshine, as well as the maxima and minima of temperatures in the same way will be made next year, and some discussion of these fuller observations will then be attempted. The observations as taken this year are given in the following tables:

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SUNSHINE TEMPERATURES.

RECORD OF MAXIMUM AND MINIMUM THERMOMETERS AT AGRICULTURAL COLLEGE, MICHIGAN, 1889.

Days of Month.	April.					May.					June.			
	Maximum.				Minimum.	Maximum.				Minimum.	Maximum.			Minimum.
	Black bulb.		Clear glass bulb.			Black bulb.		Clear glass bulb.			Black bulb.		Clear glass bulb in vacuum.	
	In vacuum.	In air.	In vacuum.	In air.		In vacuum.	In air.	In vacuum.	In air.		In vacuum.	In air.		
1	.....	.....	.....	.....	.....	87	55	62	60	20	80	58	61	40
2	.....	.....	.....	.....	.....	84	52	57	55	36	87	53	63	42
3	.....	.....	.....	.....	.....	126	75	86	80	24	92	66	67	35
4	.....	.....	.....	.....	.....	129	81	90	88	34	129	70	80	35
5	.....	.....	.....	.....	.....	135	85	95	88	36	134	79	90	46
6	.....	.....	.....	.....	.....	138	89	102	92	51	134	86	93	36
7	.....	.....	.....	.....	.....	138	93	102	99	58	72	64	67	55
8	.....	.....	.....	.....	.....	134	93	115	96	63	77	59	63	58
9	.....	.....	.....	.....	.....	148	95	107	101	60	137	86	97	50
10	.....	.....	.....	.....	.....	142	96	107	96	48	98	68	72	48
11	.....	.....	.....	.....	.....	136	85	99	90	39	135	82	94	50
12	.....	.....	.....	.....	.....	134	87	94	90	.....	139	87	98	48
13	115	63	71	68	.....	78	66	66	70	45	137	91	100	54
14	118	66	75	72	19	132	87	95	93	47	134	94	99	53
15	127	74	80	77	25	77	67	67	70	42	140	92	101	62
16	129	74	84	83	24	108	76	82	78	52	120	78	93	58
17	130	84	90	93	27	142	96	106	102	63	144	95	101	62
18	128	82	90	87	41	147	99	109	104	66	137	89	97	52
19	130	80	87	82	58	133	82	92	83	57	143	98	108	66
20	142	84	92	91	40	129	78	90	82	47	129	89	94	50
21	128	70	82	41	41	89	56	76	64	39	134	74	86	63
22	118	68	79	77	23	114	71	76	72	34	91	63	73	50
23	113	74	86	73	34	123	70	81	73	28	115	78	82	36
24	113	71	81	76	39	132	80	90	84	42	106	79	85	41
25	88	50	52	54	37	94	72	76	69	27	134	92	97	43
26	126	73	82	82	35	131	81	88	85	28	123	93	98	53
27	86	54	55	53	36	77	58	62	60	49	146	100	105	57
28	108	64	70	67	44	121	68	77	72	28	146	98	105	59
29	85	52	57	54	35	55	44	46	51	33	146	101	107	57
30	80	51	57	64	32	69	40	54	48	32	152	104	110	63
31	.....	.....	.....	.....	.....	77	56	57	61	37	.....	.....	.....	.....
Means	114.6	68.5	76.1	73.7	34.6	114.8	75.3	84.4	79.3	42.1	123.3	82.2	89.4	50.7

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SUNSHINE TEMPERATURES.

RECORD OF MAXIMUM AND MINIMUM THERMOMETERS AT AGRICULTURAL COLLEGE, MICHIGAN, 1889.

Days of Month.	July.				August.				September.				October.		
	Maximum.				Maximum.				Maximum.				Maximum.		
	Black bulb.				Black bulb.				Black bulb.				Black bulb.		
	In vacuum.	In air.	Clear glass bulb in vacuum.	Minimum.	In vacuum.	In air.	Clear glass bulb in vacuum.	Minimum.	In vacuum.	In air.	Clear glass bulb in vacuum.	Minimum.	In vacuum.	In air.	Minimum.
1	145	103	108	59	138	91	99	49	144	103	109	58	120	74	53
2	149	107	110	60	140	92	100	64	143	100	107	54	122	77	42
3	149	93	98	68	138	88	99	53	142	98	106	66	130	82	33
4	147	89	99	51	142	93	102	45	143	97	104	64	129	77	29
5	143	101	96	48	142	94	100	50	116	79	84	68	118	69	42
6	141	97	104	53	137	93	99	41	139	97	102	42	105	62	33
7	139	97	105	54	138	97	100	41	142	98	103	39	116	65	24
8	149	100	110	60	109	84	87	51	133	97	100	40	124	70	15
9	152	106	113	62	129	87	96	64	140	99	105	45	119	75	25
10	144	99	107	62	143	92	101	45	146	102	109	58	117	74	24
11	143	101	106	55	133	89	93	35	140	102	107	50	110	79	39
12	146	100	108	62	138	96	100	37	139	99	105	46	91	65	35
13	80	73	78	50	111	80	85	54	131	97	101	46	128	69	37
14	141	94	100	52	129	87	92	62	143	97	107	59	123	71	25
15	137	94	100	44	136	88	94	48	112	84	90	64	123	77	18
16	142	96	101	46	140	92	97	45	108	77	80	42	125	77	20
17	142	99	102	66	140	94	100	40	111	75	*	35	117	76	37
18	133	97	.....	67	130	90	98	44	76	57	.....	36	118	70	20
19	134	94	94	61	138	96	106	60	132	81	.....	36	123	76	20
20	149	100	104	51	137	96	105	62	105	78	.....	53	96	58	36
21	140	96	109	51	138	96	99	68	119	71	.....	32	57	97	16
22	148	95	104	48	138	95	104	47	128	80	.....	18	55	43	26
23	135	91	97	41	144	100	108	44	142	90	.....	37	113	63	9
24	143	96	102	42	138	100	136	48	137	97	.....	38	59	55	9
25	135	93	99	50	135	102	108	50	106	66	.....	61	88	57	40
26	144	98	108	56	120	95	97	53	117	67	.....	31	87	59	41
27	138	94	99	54	145	102	109	52	116	66	.....	24	52	42	34
28	122	81	89	54	141	101	106	48	130	84	.....	33	93	60	28
29	.....	....	.....	53	144	105	101	46	84	72	.....	33	58	46	19
30	145	96	102	....	141	104	109	54	75	64	.....	53	52	45	37
31	.....	....	.....	47	138	101	107	54	.....	....	.....	....	56	47	40
Means	139.8	95 9	101.9	54.3	135.8	94.2	101 3	50,1	124.6	85.8	101 2	45.8	101.8	66.4	29.2

* Thermometer broken.

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RECORD OF MAXIMUM BLACK BULB AND MINIMUM THERMOMETERS IN OPEN AIR AT GRAYLING, APRIL TO OCTOBER INCLUSIVE, 1889.

Day of Month.	Maximum—Black Bulb.							Minimum.						
	April.	May.	June.	July.	Aug.	Sept.	Oct.	April.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	60	56	111	90	94	66	.....	28	39	60	42	39	50
2	.....	62	82	106	88	98	53	.....	33	40	60	61	42	32
3	.....	65	64	80	86	94	64	.....	30	41	55	48	62	42
4	.....	85	74	82	92	96	60	.....	28	41	43	40	61	29
5	.....	.....	76	94	94	88	54	.....	55	42	43	34	55	39
6	.....	.....	86	98	98	87	66	.....	59	31	56	32	39	30
7	.....	.....	78	102	94	92	68	.....	69	50	61	39	53	30
8	.....	92	62	111	82	93	75	.....	35	49	60	55	50	20
9	.....	94	60	112	92	96	73	.....	57	42	68	65	42	35
10	.....	95	68	102	90	99	74	30	59	46	60	45	64	22
11	.....	96	72	112	90	101	74	30	37	49	61	30	54	34
12	.....	95	88	110	96	103	68	30	36	48	49	35	46	35
13	.....	93	90	110	74	102	56	20	39	60	50	50	45	19
14	.....	83	94	98	80	98	68	10	39	69	60	60	49	12
15	65	68	96	95	90	97	65	20	39	69	52	40	63	19
16	67	86	87	92	92	86	66	12	40	58	38	45	29	20
17	86	92	90	96	88	85	63	32	55	51	40	39	42	38
18	88	99	95	100	92	84	60	42	55	44	65	49	45	14
19	78	98	94	88	100	86	64	55	55	65	76	65	34	12
20	82	92	89	95	98	84	54	30	59	41	54	69	45	26
21	72	89	89	98	88	53	58	43	44	60	43	69	34	21
22	76	80	78	91	94	82	50	45	33	50	48	42	22	25
23	68	78	72	94	93	83	52	32	39	31	43	62	46	10
24	72	70	80	96	94	86	50	50	31	31	48	42	40	15
25	76	76	91	92	102	80	48	49	20	30	44	58	55	32
26	82	78	84	98	93	64	48	33	24	50	39	58	39	20
27	74	76	90	89	103	64	50	30	50	59	42	58	32	34
28	55	74	92	88	96	74	51	31	30	55	43	50	23	18
29	58	65	106	88	99	84	48	32	20	51	42	51	28	25
30	55	59	110	82	96	60	46	28	33	59	61	62	52	12
31	.....	56	.....	84	98	.....	46	.....	31	.....	61	39	.....	33
Means	72.1	80.6	83.1	96.9	92 0	87.3	59.3	35.3	40.7	48.4	50.6	49.5	44.3	25.9

V.—SUNSHINE RECORD.

Records of the sunshine have been kept, Pickering's Sunshine Recorders being used for this purpose. The value of such records as furnishing one of the physical data for studying the conditions of agriculture in a given

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region, will be obvious to any thoughtful mind. The more nearly agriculture is brought down to an absolute and determined physical basis, the more certainly we shall come to a knowledge of all the laws governing its complicated processes. As a contribution to this end the following record of the hours of sunshine by months for the season of 1889, is presented:

HOURS OF SUNSHINE DAILY AT AGRICULTURAL COLLEGE, FROM APRIL TO OCTOBER, FOR 1888 AND 1889.

Day of Month.	April.		May.		June.		July.		August.		September.	
	1888.	1889.	1888.	1889.	1888.	1889.	1888.	1889.	1888.	1889.	1888.	1889.
1	4	0	4⅓	4⅓	7	¼	13	10	13	5	10	10
2	7	0	11	0	8	0	13	0	¼	9	12	8
3	6	2	5	13	12	1¼	13	3	8	12⅓	12	5
4	11	3	0	11	14	2	12	11	7	13	10	6
5	3	0	10	13	12	9	13	8	9	9	12	1
6	12	12	10	12	8	14	5	13	4	13	12	12
7	12	12	¼	13	9	0	10	12	4	10⅓	8	12
8	11	4	0	12⅓	12	0	0	11	8	2	11	11
9	6	3	1	8	4	5	3⅓	9	8	3	12	7
10	0	12	7	8	5	0	9	5	9	8	5	10
11	7	0	7	9	12	11	11	6	7	13	10	12
12	13	0	0	10	10	12	3	13	3⅓	13	8	12
13	3	6	4	0	4	11	12	10	12	2	12	0
14	6	13	⅓	9	8	1½	2	0	10	0	12	6
15	¼	13	5	2	14	5	10	9	0	6	7	4
16	13	13	13	¼	14	¼	8	13	12	6	8	5
17	0	10	4	6	12	4	7	7	13	8	2	4
18	8	5	0	10	10	4	8	2	13	11	0	3
19	0	6	7	7	14	9	8	1	13	10	9	10
20	4	13	14	9	14	5	12	2	10	10	7	0
21	3	13	14	1⅓	10	0	4	8	5	5	10	2
22	1	13	14	3⅓	14	3	9	8	13	9	8	10
23	10	4	5	7	5	6	11	11	13	9	5	8
24	13	0	8	8	14	0	11	10	13	4	12	12
25	13	2	0	4	2	6	9	10	13	6	4	2
26	8	10	9	10	6	5	0	2	9	6	4	7
27	13	0	3	0	0	10	5	8	9	11	3	8
28	13	0	¼	13	0	10	12	4	8	13	0	12
29	10	0	12	0	5	10	7	0	7	13	12	3
30	0	0	12	0	10	13	8	5	9	13	0	0
31	.....	.....	4	0	.....	.....	3⅓	9	0	12	.....	.....
Totals	210	169	185	204	269	168	252	220	258	265	237	203

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SUMMARY OF METEOROLOGICAL OBSERVATIONS AT THE MICHIGAN AGRICULTURAL EXPERIMENT STATION, FOR THE YEAR 1888.

IN CONTINUATION OF THE SAME SERIES OF OBSERVATIONS RECORDED FOR THE MICHIGAN AGRICULTURAL COLLEGE SINCE 1863.

BY R. C. KEDZIE, PROFESSOR OF CHEMISTRY AND CHEMIST OF THE STATION.

[Latitude 42° 45′ 56″, longitude 7° 25′ 59.61″, height above the sea 834 feet.]

	Mean Daily Temperature in the Open Air.	Percentage of Humidity, Saturation=100.	Pressure of Vapor of Water in Inches of Mercury.	Height of Barometer, reduced to Temperature of 32° F.	Percentage of Cloudiness.	Amount of Rain and Melted Snow in Inches.	Snow fall in Inches.	Number of Thunderstorms.
January	15°.40	89	.....	29.202	77	2.18	12½	....
February	21 .95	85	.....	29.070	64	1.70	4	....
March	27 .03	79	.....	29 154	62	1.88	4½	....
April	44 .03	61	.....	29.202	49	1.15	½	1
May	53 .65	68	.....	29.023	64	3.66	.....	1
June	67 .89	72	.....	29.032	44	2.51	.....	2
July	70 .53	71	.....	29.119	43	2.40	.....	2
August	67 .55	71	.....	29.103	42	1.87	.....	1
September	57 .76	71	.....	29.128	45	1.89	.....	....
October	45 .70	76	.....	29.027	70	3.00	.....	3
November	38 .50	82	.....	29.167	62	3.12	3½	1
December	30 .39	83	.....	29.070	72	1.20	2½	....
Year	45°.03	76	.....	29.108	58	26.56	26¾	11

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	22	15	12	16½	86	82	80	.101	.070	.060	28.590	28.672	28.896	28.719
2	8	12	11	10½	100	80	100	.062	.060	.071	29.089	29.129	29.123	29.114
3	3	21	20	14⅝	100	86	85	.050	.096	.091	29.187	29.256	29.212	29.218
4	24	31	27	27¼	87	79	88	.111	.136	.129	28.999	28.925	29.133	29.052
5	27	30	27	28	88	89	100	.129	.148	.147	29.372	29.335	29.236	29.314
6	32	35	32	33	100	90	100	.181	.183	.181	28.845	28.895	28.907	28.882
7	35	33	31	33	90	79	100	.183	.150	.174	28.893	28.952	28.982	28.942
8	26	27	22	25	100	76	86	.141	.111	.101	29.085	29.223	29.394	29.234
9	16	22	20	19½	100	86	85	.090	.096	.091	29.437	29.311	29.191	29.313
10	17	15	6	12⅝	83	82	100	.078	.070	.057	29.023	29.070	29.268	29.120
11	1	10	7	6	100	79	100	.046	.054	.060	29.482	29.597	29.652	29.577
12	3	17	23	14½	100	67	100	.050	.063	.123	29.596	29.302	28.949	29.282
13	36	13	7	18⅝	80	62	100	.170	.048	.060	28.723	29.146	29.419	29.096
14	2	22	18	14	100	70	100	.048	.075	.098	29.448	29.333	29.246	29.309
15	8	12	-6	4⅝	78	80	100	.048	.060	.033	29.382	29.600	29.754	29.579
16	-5	12	4	3⅝	100	80	100	.035	.057	.052	29.849	29.809	29.711	29.790
17	11	15	10	12	80	82	100	.057	.070	.068	29.252	29.143	29.231	29.209
18	13	18	7	12⅝	81	100	100	.063	.094	.060	29.254	29.258	29.341	29.284
19	8	12	15	11⅝	100	100	82	.062	.075	.070	29.285	29.128	29.118	29 177
20	3	9	10	7⅓	100	100	79	.050	.062	.068	29.257	29.305	29.241	29.268
21	-15	10	-8	-4⅓	100	78	100	.023	.048	.031	29.652	29.631	29.621	29.635
22	-6	18	1	4⅓	100	65	100	.033	.055	.046	29.625	29.536	29.391	29.517
23	10	22	15	15⅝	79	86	82	.054	.101	.070	29.338	29.246	29.409	29.331
24	-9	15	11	5⅝	100	66	100	.029	.059	.071	29.577	29.493	29.338	29.469
25	15	27	24	12	82	88	86	.070	.129	.106	28.811	29.602	28.587	28.666
26	9	18	15	14	100	83	82	.065	.078	.070	29.095	29.087	29.098	29.093
27	11	12	-1	7⅓	100	80	100	.068	.060	.042	29.098	29.285	29.188	29.190
28	-1	17	12	9⅓	100	67	80	.042	.063	.060	29.280	29.345	29.265	29.297
29	19	25	24	22⅔	69	61	87	.071	.077	.111	29.033	28.952	28.935	28.973
30	26	29	29	28	88	89	100	.123	.142	.160	28.915	28.870	28.887	28.891
31	26	29	29	28	100	89	89	.141	.142	.142	29.032	29.117	29.203	29.117
Sums														
Means				15.40	93	81	93	.080	.088	.087				29.170
Average						89			.085					

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JANUARY, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7. A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	St.	90	St.	100	St.	s w	12	s w	16	s w	8	22	8	.....	.....	.....	.....
100	St.	90	St.	100	St.	s w	8	s w	2	s w	9	12	3	In night	.....	.05	⅛
15	St.	100	St.	100	St.	s w	1	s w	8	s w	3	34	3	.....	.....	.....	.....
100	St.	100	St.	100	St.	s e	6	s e	3	n e	7	31	24	.....	.....	.....	.....
100	St.	100	St.	100	Nim.	n	6	e	7	e	4	32	26	6 p. m.	.....	.....	.....
100	Nim.	100	Fog.	100	Nim.	s e	2	....	0	e	2	35	32	.....	11 p. m.	.88	.....
100	St.	100	St.	100	Nim.	s w	3	n w	2	....	0	36	26	6 p. m.	.....	.....	.....
100	Nim.	60	Cu.	100	St.	n w	6	n w	11	....	0	32	16	.....	8 a. m.	.15	1½
100	St.	100	St.	100	St.	n	2	s w	12	s w	4	24	16	.....	.....	.....	.....
70	Cu. St.	100	Nim.	40	St.	s w	16	s w	16	s w	6	17	0	8 a. m.	7 p. m.	.10	1
10	St.	80	Cu. St.	100	St.	n w	4	w	12	w	5	10	1	.....	.....	.....	.....
10	St.	100	St.	100	Nim.	s e	9	s e	12	s e	16	36	3	4 p. m.	.....	.....	.....
100	Nim.	100	Nim.	100	St.	s w	28	w	28	w	12	36	-1	.....	3 p. m.	.40	
90	St.	90	St.	100	Nim.	s	4	e	4	s e	2	32	2	7 p. m.	12 p. m.	.20	2
60	St.	20	Cu.	00	.....	w	12	n w	12	w	2	12	-11	.....	.....	.....	.....
90	St.	30	St.	100	St.	n w	1	s w	2	e	4	14	-5	.....	.....	.....	.....
100	Nim.	100	Nim.	20	St.	n e	3	w	7	w	3	16	6	7 a. m.	.....	.....	.....
100	Nim.	100	Nim.	10	St.	w	4	w	12	....	0	19	0	.....	4 p. m.	.10	1
100	Cir. St.	100	Nim.	100	St.	s w	8	s	8	s w	8	14	3	.....	.....	.....	.....
100	St.	90	St.	100	St.	n w	8	n w	6	n w	6	14	-16	.....	.....	.....	.....
10	St.	00	.....	30	St.	w	1	....	0	....	0	11	-15	.....	.....	.....	.....
00	.....	00	.....	100	St.	e	1	s	1	n w	2	18	-6	.....	.....	.....	.....
100	St.	100	Nim.	100	St.	s	4	s w	12	n w	4	22	-11	.....	.....	.....	.....
10	St.	80	St.	50	St.	e	2	s e	7	s	12	17	-9	.....	.....	.....	.....
100	Nim.	100	Nim.	50	St.	s e	8	w	12	w	16	26	8	7 a. m.	6 p. m.	.30	3
10	St.	10	St.	100	Nim.	w	12	w	8	n	1	25	8	.....	.....	.....	.....
100	St.	00	.....	10	St.	n e	1	n w	6	n w	5	26	-14	.....	.....	.....	.....
00	.....	5	St.	30	St.	n w	1	w	1	w	1	19	-1	.....	.....	.....	.....
100	St.	100	St.	100	St.	s e	1	s e	1	....	0	26	19	.....	.....	.....	.....
100	St.	100	St.	100	St.	....	0	s	1	e	1	29	26	.....	.....	.....	.....
100	St.	100	St.	100	St.	....	0	n w	1	....	0	29	26	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	2.18	12½
73	.....	76	.....	81	.....	....	....	....	....	....	....	28.10	5.39	.....	.....	.....	.....
				77													

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	29	32	30	30½	89	89	78	.142	.155	.180	29.351	29.391	29.441	29.394
2	26	32	21	26½	100	79	100	.141	.143	.113	29.431	29.363	29.371	29.388
3	22	33	31	28⅝	100	89	89	.118	.162	.155	29.345	29.306	29.245	29.299
4	27	35	31	31	100	79	100	.147	.155	.174	28.872	28.715	28.733	28.773
5	22	26	17	21⅝	100	75	83	.118	.100	.078	28.985	29.014	29.045	29.015
6	13	22	23	19½	100	72	86	.078	.084	.106	29.128	29.120	28.861	29.036
7	28	31	27	29⅝	88	89	76	.135	.155	.111	28.768	28.547	28.705	28.673
8	6	7	1	4⅝	100	77	100	.057	.045	.046	28.783	28.787	28.898	28.823
9	-16	2	-16	-10	100	72	100	.022	.034	.022	29.187	29.255	29.203	29.215
10	-2	12	13	7⅝	67	61	81	.027	.045	.063	29.128	29.002	29.045	29.058
11	-7	19	2	4⅝	100	69	100	.032	.071	.048	29.103	29.092	29.098	29.098
12	-2	30	27	18½	100	78	76	.040	.130	.111	29.090	28.992	29.085	29.059
13	26	45	40	37	75	61	73	.105	.235	.182	29.095	29.042	28.992	29.043
14	35	21	7	21	100	100	77	.204	.113	.045	29.067	29.280	29.545	29.297
15	-10	4	-1	-2½	100	100	100	.028	.050	.042	29.869	29.878	29.783	29.843
16	6	33	33	24	75	61	70	.041	.113	.131	29.479	29.185	29.092	29.252
17	23	38	33	31½	100	72	79	.123	.165	.150	29.115	29.025	28.912	29.017
18	27	41	30	32⅝	100	49	89	.147	.126	.148	29.032	29.125	29.157	29.105
19	30	38	39	35⅝	89	81	100	.148	.186	.238	29.032	28.787	28.677	28.832
20	35	24	23	27½	80	87	86	.162	.111	.106	28.599	28.743	28.870	28.734
21	21	28	23	24	100	76	100	.113	.111	.123	29.175	29.196	29.288	29.220
22	18	40	35	31	100	46	70	.098	.110	.142	29.458	29.361	29.279	29.366
23	33	44	30	35⅝	89	60	89	.168	.173	.148	29.214	29.193	29.228	29.212
24	27	45	37	36½	100	68	100	.147	.196	.221	29.138	28.907	28.522	28.856
25	42	32	17	30⅝	90	89	83	.235	.162	.078	28.254	28.399	28.577	28.412
26	10	10	4	8	100	100	100	.068	.068	.052	28.743	28.843	28.968	28.851
27	3	8	4	5	100	78	74	.050	.048	.038	29.000	29.115	29.305	29.140
28	5	23	16	14⅝	75	47	83	.041	.056	.074	29.352	29.162	29.122	29.212
29	26	40	35	33⅝	75	56	80	.117	.189	.162	29.092	29.209	29.241	29.181
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	.....	.....	.....	21.93	93	74	87	.105	.119	.112	.....	.....	.....	29.069
Average						85			.112					

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FEBRUARY, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	St.	100	St.	100	St.	n	1	....	0	....	0	32	26	.....	.....	.....	.....
100	St.	60	St.	00	.....	s e	4	s	4	....	0	32	13	.....	.....	.....	.....
100	Fog.	100	St.	100	St.	....	0	e	6	e	6	32	22	.....	.....	.....	.....
100	St.	100	St.	100	Nim.	e	2	e	3	w	5	35	22	4 p. m.	10 p. m.	.....	½
100	St.	30	Cu.	00	.....	n	5	n w	8	n w	2	28	8	.....	.....	.....	.....
100	St.	100	St.	100	St.	s w	2	s w	8	s	12	28	13	.....	.....	.....	.....
100	St.	100	Nim.	100	St.	s w	12	s w	4	w	12	31	6	10 a. m.	6 p. m.	.20	2
50	Cu.	90	St.	100	St.	s w	12	s w	16	s w	16	10	-17	.....	.....	.....	.....
20	St.	00	.....	00	.....	....	0	s w	4	....	0	2	-19	.....	.....	.....	.....
100	St.	100	St.	100	St.	....	0	s w	2	....	0	13	-10	.....	.....	.....	.....
30	Cir. St.	10	St.	00	.....	....	0	s w	1	....	0	24	-7	.....	.....	.....	.....
40	St.	75	St.	100	St.	s	1	s	5	s w	4	30	-2	.....	.....	.....	.....
00	.....	70	Cir. St.	40	St.	s	8	s w	16	s w	20	45	24	.....	.....	.....	.....
100	Nim.	100	St.	00	.....	....	0	n	6	n	8	35	-11	5 a. m.	6 p. m.	.10	½
00	.....	00	.....	00	.....	n	4	s	2	....	0	6	-10	.....	.....	.....	.....
30	Cir.Cu.	00	.....	00	.....	s	12	s w	20	s w	16	33	6	.....	.....	.....	.....
100	St.	100	St.	100	St.	w	2	s w	8	w	12	38	23	.....	.....	.....	.....
30	Cir.Cu.	00	.....	00	Haze.	....	0	....	0	e	3	41	26	.....	.....	.....	.....
100	St.	100	Nim.	100	Nim.	s e	6	s e	8	s	7	42	30	2 p. m.	12 m.	.65	.....
100	St.	100	St.	100	St.	s w	20	w	28	w	16	35	21	.....	.....	.....	.....
100	St.	90	Cu. St.	00	.....	w	12	s w	8	....	0	30	15	.....	.....	.....	.....
60	Cir.Cu.	20	Cu.	30	St.	w	1	s	6	s	6	40	18	.....	.....	.....	.....
70	St.	20	Cu.	00	.....	s	2	n w	3	....	0	45	27	.....	.....	.....	.....
80	Cir.Cu.	60	Cu. St.	100	Nim.	e	5	e	8	e	12	45	27	5 p. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	s w	20	s w	28	s w	24	42	10	.....	10 p. m.	.75	½
100	Nim.	60	Cu. St.	10	St.	s w	16	s w	24	w	8	12	2	.....	.....	.....	.....
80	Cu. St.	60	Cu. St.	00	.....	s w	6	n w	12	n w	5	11	-1	.....	.....	.....	.....
100	St.	80	St.	30	St.	s w	6	s	12	s	5	26	5	.....	.....	.....	.....
100	St.	60	Cu. St.	100	St.	...	0	s	3	....	0	41	25	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	1.70	4
74	.....	65	.....	54	.....	....	....	....	....	....	....	29.79	10.07	.....	.....	.....	.....
			64														

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	30	27	30	29	89	100	100	.148	.141	.167	29.231	29.231	29.183	29.212
2	39	42	26	35⅞	100	83	88	.238	.222	.123	28.958	28.962	29.253	29.058
3	15	23	10	16	82	86	79	.070	.106	.054	29.516	29.495	29.583	29.515
4	7	17	13	12⅓	77	67	81	.045	.074	.063	29.529	29.435	29.375	29.446
5	5	17	12	11⅓	100	83	100	.055	.078	.075	29.191	29.122	29.140	29.151
6	6	29	20	18⅓	100	56	70	.055	.087	.075	29.138	29.087	29.151	29.125
7	12	36	25	24⅓	100	45	87	.075	.096	.117	29.154	29.108	29.231	29.163
8	17	40	27	28	100	31	88	.090	.077	.129	29.342	29.376	29.430	29.383
9	27	40	36	34⅓	76	39	61	.111	.097	.129	29.496	29.416	29.331	29.414
10	36	40	41	39	90	82	100	.191	.203	.257	29.186	29.020	28.930	29.045
11	22	28	19	23	72	66	85	.084	.099	.087	29.132	29.185	29.340	29.219
12	9	21	17	15⅝	100	70	67	.065	.075	.063	29.549	29.533	29.491	29.524
13	6	22	13	13⅝	100	71	100	.057	.090	.078	29.472	29.365	29.335	29.391
14	9	31	23	21	100	100	100	.065	.174	.123	29.426	29.428	29.413	29.422
15	24	46	38	36	100	40	38	.129	.125	.091	29.385	29.275	29.118	29.359
16	34	40	30	34⅓	90	56	68	.175	.139	.111	29.118	29.125	29.145	29.129
17	20	30	20	23⅓	70	68	85	.075	.111	.091	29.112	29.102	29.153	29.122
18	21	42	34	32⅓	86	50	70	.096	.134	.138	29.081	29.005	28.960	29.015
19	42	68	52	54	74	38	79	.199	.261	.308	28.830	28.655	28.617	28.701
20	50	35	31	38⅝	93	100	79	.335	.204	.136	28.479	28.587	28.710	28.592
21	30	32	18	26⅝	89	59	84	.148	.106	.082	28.607	28.720	28.837	28.721
22	6	13	6	8⅓	100	62	52	.057	.048	.029	29.043	29.145	29.293	29.160
23	6	22	19	15⅝	76	45	85	.043	.052	.087	29.347	29.293	29.305	29.315
24	8	24	15	15⅝	100	60	82	.062	.073	.070	29.392	29.428	29.456	29.425
25	14	25	23	20⅝	64	75	86	.051	.100	.106	29.412	29.310	29.087	29.236
26	34	38	36	36	90	100	90	.175	.229	.191	28.847	28.700	28.932	28.826
27	32	34	30	32	89	79	89	.162	.155	.148	29.075	29.092	29.057	29.075
28	26	34	31	30⅓	100	70	69	.141	.138	.118	29.042	28.997	29.055	29.031
29	28	43	34	35	88	67	79	.135	.186	.155	29.108	29.052	29.158	29.105
30	32	52	32	38⅝	89	60	100	.162	.232	.181	29.166	28.982	29.176	29.108
31	32	48	35	38⅓	89	49	70	.162	.165	.142	29.257	29.245	29.243	29.248
Sums														
Means				27.03	89	66	81	.118	.131	.120				29.154
Average						79			.123					

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MARCH, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	Nim.	100	Nim.	100	Nim.	e	7	e	7	n e	3	39	26	6 a. m.	.....	.....	.....
100	Nim.	100	Nim.	100	St.	s	5	w	24	w	20	47	15	.....	2 p. m.	.35	.....
90	Cu. St.	40	Cu.	00	.....	s w	12	n w	8	w	6	23	4	.....	.....	.....	.....
100	St.	100	Cu. St.	100	St.	n e	4	n e	8	n e	4	17	5	.....	.....	.....	.....
80	St.	70	Cu. St.	00	.....	n e	6	n	8	....	0	19	4	.....	.....	.....	.....
00	.....	50	Cu.	00	.....	n w	6	s w	12	w	4	29	6	.....	.....	.....	.....
00	.....	20	Cu.	00	.....	w	4	s w	8	w	8	36	15	.....	.....	.....	.....
00	.....	00	.....	00	.....	w	2	w	8	....	0	41	17	.....	.....	.....	.....
90	St.	100	Cu. St.	100	St.	s e	8	s e	8	s e	2	41	27	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	s e	1	s	2	s w	2	41	22	5 a. m.	11 p. m.	.50	.....
80	Cu. St.	40	Cu.	100	St.	n w	20	w	20	w	12	29	5	.....	.....	.03	½
00	.....	50	Cu.	00	.....	n w	5	n w	12	n	8	22	5	.....	.....	.....	.....
00	.....	00	.....	00	.....	n	12	n w	16	n	12	21	6	.....	.....	.....	.....
50	Cu.	00	.....	00	.....	n	12	n e	5	w	1	31	9	.....	.....	.....	.....
10	St.	80	St.	100	St.	w	8	s w	16	s w	12	46	24	.....	.....	.....	.....
100	St.	70	Cu. St.	50	St.	n w	8	n w	12	n	12	40	20	.....	.....	.....	.....
100	St.	60	Cu. St.	00	.....	n e	8	e	5	n	3	32	18	.....	.....	.....	.....
100	St.	30	Cir. Cu.	100	St.	s	7	s	8	s	16	42	21	.....	.....	.....	.....
100	St.	100	St.	100	Nim.	s	12	s	20	s w	24	69	42	6 p. m.	.....	.....	.....
100	Nim.	100	Cu. St.	100	St.	s	16	w	16	w	8	50	29	.....	11 a. m.	.15	.....
90	Cu. St.	60	Cu.	60	Cu.	w	12	w	20	w	16	32	5	.....	.....	.05	½
50	Cu.	60	Cu. St.	30	Cu.	w	8	w	16	w	8	15	2	.....	.....	.....	.....
30	Cir. Cu.	90	Cu. St.	60	St.	w	5	s w	5	e	6	22	6	.....	.....	.....	.....
5	St.	80	Cir. St.	10	St.	e	8	e	6	e	6	24	8	.....	.....	.....	.....
90	St.	100	Nim.	100	Nim.	e	12	e	12	e	12	34	14	2 p. m.	.....	.....	.....
100	Nim.	100	Nim.	100	St.	e	4	s	12	s w	8	42	31	.....	3 p. m.	.70	2
100	St.	100	St.	100	St.	w	2	s w	4	n w	4	34	26	.....	.....	.....	.....
100	Nim.	50	Cu. St.	100	St.	n	2	w	8	w	8	36	24	5 a. m.	10 a. m.	.10	1½
70	St.	60	Cu. St.	30	St.	s w	8	s w	16	....	0	43	28	.....	.....	.....	.....
100	St.	50	Cu. St.	20	St.	s e	4	w	16	w	12	54	29	.....	.....	.....	.....
100	St.	20	Cir. St.	00	.....	w	6	w	8	w	3	48	29	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	1.88	4½
67	.....	64	.....	54	.....	----	----	----	----	----	----	35.45	16.84	.....	.....	.....	.....
62																	

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	35	52	38	41⅓	61	47	91	.127	.183	.208	29.063	28.740	28.750	28.851
2	34	40	28	34	79	56	77	.155	.139	.117	28.907	29.010	29.141	28.986
3	26	41	37	34⅓	87	33	71	.117	.184	.157	29.241	29.251	29.272	29.255
4	31	54	45	43⅓	89	43	61	.155	.181	.182	29.445	29.333	29.235	29.354
5	45	68	49	54	100	74	78	.300	.509	.272	28.818	28.732	28.982	28.844
6	37	51	43	43⅔	71	26	51	.157	.104	.142	29.376	29.366	29.358	29.366
7	36	47	30	37⅞	61	36	78	.129	.112	.180	29.431	29.438	29.475	29.448
8	30	48	40	39⅓	89	28	73	.148	.133	.182	29.532	29.426	29.426	29.468
9	38	55	43	45⅓	68	33	92	.144	.144	.254	29.325	29.151	29.028	29.168
10	48	40	39	42⅓	93	82	82	.310	.208	.195	28.619	28.668	29.017	28.768
11	37	53	40	43	71	41	65	.157	.159	.160	29.226	29.216	29.291	29.244
12	30	45	33	36	68	30	70	.111	.087	.131	29.456	29.493	29.491	29.480
13	31	50	47	42⅞	69	26	77	.118	.094	.249	29.381	29.043	28.913	29.112
14	39	49	39	42⅔	82	44	64	.195	.152	.152	29.072	29.191	29.233	29.165
15	36	42	36	38	90	74	90	.191	.199	.191	29.154	28.978	28.950	29.027
16	34	51	39	41⅓	79	40	55	.155	.149	.131	29.301	29.330	29.385	29.339
17	34	48	47	43	61	49	62	.120	.165	.202	29.329	29.241	29.065	29.212
18	38	47	36	40⅓	54	34	80	.123	.112	.170	29.123	29.148	29.143	29.138
19	38	48	35	40⅓	63	36	80	.144	.120	.162	29.090	29.085	29.122	29.099
20	35	39	37	37	80	46	45	.162	.110	.103	29.183	29.208	29.178	29.190
21	35	48	41	41⅓	61	43	65	.127	.143	.169	29.213	29.125	29.135	29.158
22	35	48	40	41	70	36	48	.142	.120	.118	29.149	29.065	29.087	29.100
23	35	50	33	39⅓	61	32	61	.127	.117	.113	29.250	29.263	29.378	29.297
24	32	50	39	40⅓	79	32	55	.143	.117	.131	29.544	29.565	29.535	29.548
25	40	58	47	48⅓	56	32	48	.139	.153	.156	29.602	29.506	29.461	29.523
26	48	75	64	63⅓	49	30	48	.165	.256	.285	29.451	29.405	29.395	29.414
27	61	81	62	68	50	41	72	.269	.417	.390	29.436	29.395	29.398	29.410
28	57	81	62	66⅔	69	32	61	.322	.335	.340	29.405	29.325	29.288	29.339
29	66	68	42	58⅔	50	51	66	.316	.349	.177	29.201	29.072	29.072	29.118
30	37	37	32	35⅔	90	90	100	.199	.199	.181	29.005	28.958	29.012	28.992
Sums														
Means				44.08	72	43	69	.173	.181	.185				29.202
Averages						61			.179					

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APRIL, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	St.	30	Cir.	50	Cir.	e	8	se	6	n	7	55	29	.....	.....	.....	.....
00	.....	90	Cu. St.	00	.....	w	12	nw	16	nw	6	44	22	.....	.....	.....	.....
10	St.	100	St.	100	St.	ne	5	sw	8	....	0	41	25	.....	.....	.....	.....
00	.....	60	Cir. St.	60	St.	....	0	e	8	e	12	55	31	.....	.....	.....	.....
100	Nim.	60	Cu. St.	20	Cu. St.	sw	16	sw	12	sw	12	68	35	2 a. m.	9 a. m.	.20	.....
00	.....	00	.....	00	.....	w	12	w	28	w	10	51	35	.....	.....	.....	.....
10	St.	00	.....	00	.....	nw	8	n	12	n	4	48	21	.....	.....	.....	.....
10	St.	40	Cir.	60	St.	se	8	e	6	se	8	48	30	.....	.....	.....	.....
70	Cir.Cu.	100	St.	100	Nim.	se	12	e	12	e	12	57	38	6 p. m.	.....	.....	.....
100	Nim.	100	Cu. St.	100	St.	sw	8	sw	16	nw	16	54	34	.....	6 p. m.	.35	.....
80	St.	100	Cu. St.	40	St.	w	12	w	8	w	6	58	27	.....	.....	.....	.....
00	.....	00	.....	00	.....	nw	12	nw	12	nw	6	45	27	.....	.....	.....	.....
100	St.	100	Cir.Cu.	80	Nim.	s	12	w	18	w	16	52	37	9 p. m.	11 p. m.	.18	.....
100	Cu. St.	80	Cu.	00	.....	nw	8	nw	12	....	0	50	36	.....	.....	.....	.....
100	Cu. St.	100	St.	100	St.	s	16	se	12	ne	8	42	32	.....	.....	.....	.....
10	St.	10	Cu.	00	.....	ne	5	ne	5	ne	6	52	34	.....	.....	.....	.....
100	Nim.	90	Cu. St.	100	Cu. St.	e	10	s	12	w	16	48	33	7 a. m.	11 a. m.	.05	.....
5	Cu. St.	90	Cu. St.	00	.....	w	16	sw	20	....	0	48	30	.....	.....	.....	.....
100	Hazy.	70	Cu.	70	Cu.	w	8	nw	8	w	8	47	28	.....	.....	.....	.....
5	Cu.	70	Cu.	10	St.	nw	12	nw	12	nw	2	44	25	.....	.....	.....	.....
70	Cir.Cu.	100	Cu. St.	100	St.	nw	2	w	8	w	4	52	31	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	St.	e	2	e	6	ne	8	48	32	.....	.....	.....	.....
50	Cir.Cu.	60	Cu.	00	.....	n	12	nw	12	n	4	51	25	.....	.....	.....	.....
00	.....	10	Cu.	00	.....	n	6	nw	4	....	0	51	31	.....	.....	.....	.....
00	.....	10	St.	30	Cir. St.	s	8	s	12	s	8	60	40	.....	.....	.....	.....
10	St.	20	Cir Cu.	40	Cir. St.	s	12	sw	16	s	8	75	48	.....	.....	.....	.....
00	.....	20	Cu.	00	.....	sw	8	sw	8	....	0	81	52	.....	.....	.....	.....
00	.....	00	.....	00	.....	....	0	sw	12	....	0	81	47	.....	.....	.....	.....
40	Cir.Cu.	70	Cu. St.	50	St.	sw	4	ne	16	ne	10	79	36	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	ne	8	n	8	n	4	37	30	5 a. m.	10 p. m.	.37	⅛
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	1.15	⅛
46	.....	59	.....	42	.....	----	----	----	----	----	----	54.07	32.50	.....	.....	.....	.....
		49															

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	38	43	33	36½	89	59	89	.168	.164	.168	29.087	29.146	29.155	29.129
2	35	55	45	45	61	32	46	.127	.133	.138	29.301	29.228	29.241	29.257
3	43	64	53	53⅓	59	43	54	.164	.257	.219	29.158	29.010	28.895	29.021
4	55	52	44	50⅓	74	72	84	.321	.270	.241	28.818	28.898	28.942	28.883
5	46	58	46	50	62	47	84	.192	.216	.262	29.083	29.143	29.243	29.156
6	57	70	55	60⅔	69	43	39	.322	.306	.168	29.328	29.316	29.338	29.327
7	45	48	45	46	61	56	76	.182	.189	.228	29.469	29.410	29.315	29.431
8	45	54	54	51	92	93	100	.275	.390	.418	29.100	29.028	28.970	29.033
9	57	62	55	58	87	67	81	.407	.370	.349	28.913	28.980	28.940	28.928
10	54	64	64	60⅔	80	100	68	.405	.596	.403	28.903	28.918	28.823	28.881
11	66	77	64	69	59	46	83	.376	.422	.497	28.863	28.812	28.760	28.812
12	48	43	38	43	78	59	72	.260	.164	.165	28.722	28.905	28.973	28.869
13	35	39	39	37⅔	70	64	73	.142	.152	.173	28.998	29.013	29.042	29.018
14	36	41	37	38	80	57	81	.170	.147	.178	29.000	29.025	29.082	29.036
15	39	54	43	45⅓	82	38	51	.195	.157	.142	29.038	28.955	28.998	28.997
16	41	52	43	45⅓	51	40	51	.142	.149	.142	29.076	29.070	29.123	29.090
17	47	60	44	50⅓	48	29	84	.156	.152	.241	29.197	29.156	29.120	29.154
18	44	48	45	45⅔	84	93	92	.241	.322	.275	28.956	28.880	28.952	28.913
19	40	52	43	45	91	59	84	.225	.221	.231	29.161	29.263	29.293	29.239
20	48	66	53	55⅔	77	39	61	.249	.230	.244	29.379	29.306	29.283	29.323
21	53	71	58	60⅔	60	28	42	.232	.206	.203	29.272	29.168	29.146	29.195
22	57	80	62	66⅓	58	34	46	.268	.349	.256	29.145	29.090	29.062	29.099
23	57	78	61	65⅓	69	29	50	.322	.278	.269	29.068	29.005	28.992	29.020
24	60	71	61	64	77	58	77	.396	.426	.418	29.098	29.047	28.940	29.028
25	58	63	59	60	94	89	100	.452	.510	.500	28.875	28.862	28.890	28.876
26	58	71	61	63⅓	94	57	82	.452	.523	.442	28.972	28.982	28.942	28.969
27	61	70	65	65⅓	82	75	89	.442	.551	.549	28.875	28.742	28.742	28.786
28	63	65	58	62	89	94	94	.510	.583	.452	28.722	28.632	28.765	28.706
29	56	68	60	61⅓	87	60	82	.391	.411	.426	28.938	28.922	28.988	28.933
30	49	65	53	55⅔	57	52	67	.199	.299	.269	29.164	29.098	29.013	29.092
31	50	61	47	52⅔	93	55	77	.335	.297	.249	28.941	28.891	28.911	28.914
Sums														
Means				53.65	75	57	73	.281	.348	.287				29.055
Average						68			.305					

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MAY, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	Cu. St.	60	Cu.	00	.....	n	4	n e	4	....	0	46	25	.....	.....	.....	.....
10	St.	20	Cir.Cu.	100	St.	e	6	e	8	s e	1	55	35	.....	.....	.....	.....
100	St.	30	Cir. St.	30	Cu. St.	e	8	s e	12	s e	12	66	43	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	Nim.	s e	8	s	16	s w	16	62	41	9 a. m.	3 p. m.	.09	.....
20	Cu.	5	Cu.	10	St.	w	12	w	12	....	0	59	40	.....	.....	.....	.....
10	Cu.	20	Cu.	00	.....	w	8	w	8	n	6	71	43	.....	.....	.....	.....
100	St.	100	Nim.	100	Nim.	e	12	n e	8	n e	6	48	42	11 a. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	e	4	e	4	e	2	57	44	.....	.....	.....	.....
100	Nim.	100	Cu. St.	80	Cir.Cu.	w	2	w	8	s w	1	64	46	.....	9 a. m.	.70	.....
80	Cu.	80	Cir.Cu.	00	.....	w	10	s w	8	....	0	68	54	.....	.....	.....	.....
30	Cu. St.	70	Cu.	100	Cu. St.	s	10	s w	8	....	0	80	47	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	Cu. St.	s w	12	w	12	w	5	52	34	1 a. m.	5 a. m.	1.00	.....
100	Nim.	100	Cu. St.	100	St.	w	12	w	16	w	8	40	34	.....	.....	.....	.....
100	St.	100	St.	50	St.	w	8	w	12	....	0	40	28	.....	.....	.....	.....
40	Cir.Cu.	100	Cu. St.	00	.....	s e	8	w	12	n w	4	56	29	.....	.....	.....	.....
00	.....	70	Cu.	00	....	n w	8	w	20	n w	4	56	29	.....	.....	.....	.....
80	Cu. St.	90	Cu. St.	100	Cu. St.	s	8	s	16	e	4	61	40	5 p. m.	.....	.04	.....
100	Nim.	100	Nim.	100	Nim.	e	4	s e	8	w	5	49	40	.....	5 p. m.	.45	.....
100	Nim.	50	Cu.	00	.....	w	12	n w	1	....	0	55	33	.....	.....	.....	.....
10	St.	10	Cir.	5	St.	w	12	s e	8	....	0	66	40	.....	.....	.....	.....
10	St.	20	St.	10	Cir.	s	4	e	4	....	0	71	47	.....	.....	.....	.....
10	St.	00	.....	20	Cir.	s e	4	e	8	s e	4	80	49	.....	.....	.....	.....
90	St.	80	Cir. St.	70	St.	s e	4	e	4	....	0	78	49	.....	.....	.....	.....
80	Cir.Cu.	90	Cu. St.	10	Cir.	....	0	e	8	....	0	74	54	.....	.....	.....	.....
100	Cu. St.	100	Nim.	100	Nim.	e	4	e	6	e	3	64	56	11 a. m.	10 p. m.	.18	.....
100	St.	40	Cu.	100	Cu. St.	w	5	n w	4	w	4	71	53	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	Nim.	e	8	s	4	s	4	73	61	9 a. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	e	5	e	8	w	12	67	50	.....	10 p. m.	1.00	.....
00	.....	90	Cu. St.	50	Cu. St.	n w	7	s w	8	s w	7	70	43	.....	....	.....	.....
10	St.	40	Cu.	10	Cu.	e	8	e	12	e	1	64	45	7 a. m.	10 p. m.	.20	.....
100	Cu. St.	40	Cu.	70	Cu.	e	8	w	4	w	2	61	39	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	3.66	.....
67	.....	68	.....	57	.....	----	----	----	----	----	----	62.06	42.52	.....	.....	.....	.....

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	59	63	50	57½	88	47	79	.269	.270	.283	28.958	28.868	28.933	28.920
2	50	60	47	52½	39	44	85	.139	.229	.273	29.035	29.105	29.174	29.105
3	53	65	53	56⅔	73	43	66	.295	.257	.257	29.226	29.164	29.184	29.191
4	54	70	60	61½	67	40	65	.282	.296	.338	29.219	29.238	29.191	29.216
5	61	80	69	70	61	41	70	.325	.417	.496	29.193	29.044	29.065	29.101
6	70	64	53	62½	70	58	80	.516	.343	.321	29.065	29.153	29.271	29.163
7	47	65	54	55½	85	58	87	.273	.343	.362	29.341	29.308	29.271	29.307
8	54	75	68	65⅔	87	48	65	.362	.415	.443	29.246	29.141	29.092	29.160
9	67	80	71	72⅔	79	55	80	.522	.561	.608	29.015	28.879	28.852	28.915
10	71	66	51	62⅔	80	64	86	.608	.407	.321	28.767	28.792	28.895	28.818
11	51	66	57	58	79	49	63	.296	.301	.295	29.103	29.138	29.161	29.134
12	59	73	65	65⅔	65	35	54	.323	.283	.330	29.192	29.145	29.108	29.148
13	63	75	64	67½	67	72	100	.386	.638	.596	29.068	28.947	28.982	28.979
14	67	79	71	72⅓	100	70	90	.662	.691	.682	29.012	28.970	28.975	28.986
15	73	86	71	76⅔	81	51	75	.655	.687	.572	28.962	28.987	29.014	28.988
16	68	87	70	75	84	45	90	.577	.583	.658	29.060	29.052	29.037	29.050
17	71	92	75	79½	90	45	90	.682	.680	.785	29.062	29.051	29.054	29.062
18	76	91	75	80⅔	73	50	90	.652	.678	.785	29.069	29.079	29.089	29.079
19	74	88	77	79⅔	76	56	69	.641	.735	.639	29.127	29.093	29.042	29.087
20	70	90	79	79⅔	70	35	62	.516	.478	.612	29.014	28.946	28.904	28.955
21	72	87	72	77	95	62	85	.745	.792	.668	28.909	28.869	28.889	28.889
22	73	85	74	77½	85	54	81	.693	.650	.680	28.860	28.859	28.877	28.865
23	69	84	73	75½	95	60	85	.671	.677	693	28.914	28.859	28.912	28.895
24	68	82	66	72	90	46	69	.612	.497	.438	28.897	28.917	28.960	28.925
25	64	72	63	66½	89	76	89	.529	.595	.510	28.945	28.915	28.987	28.932
26	56	70	65	63⅔	87	61	73	.391	.449	.451	29.018	29.052	29.098	29.056
27	54	67	60	60½	80	69	94	.385	.457	.487	29.093	28.998	28.940	29.010
28	57	65	62	61½	100	89	77	.466	.549	.429	28.980	28.988	29.122	29.013
29	56	68	60	61⅓	87	74	94	.391	.489	.487	29.206	29.266	29.221	29.231
30	61	82	71	71½	94	60	85	.505	.650	.644	29.253	29.180	29.138	29.190
31														
Sums														
Means				67.89	81	55	79	.477	.508	.505				29.082
Average						72			.497					

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JUNE, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
00	.....	70	Cu.	00	.....	w	8	s w	12	n	4	65	43	2 p. m.	5 p. m.	.18	.....
30	Cu.	70	Cu.	00	.....	n	8	n e	5	n	1	60	36	.....	.....	.....	.....
00	.....	40	Cu.	00	.....	----	0	n	6	w	1	68	40	.....	.....	.....	.....
00	.....	00	.....	00	.....	----	0	s w	8	s w	8	70	53	.....	.....	.....	.....
30	Cir.	20	Cir.	00	.....	s	8	s	12	s w	12	80	61	.....	.....	.....	.....
70	Cir. St.	80	Cu. St.	00	.....	w	16	w	12	n w	2	70	42	.....	.....	.....	.....
100	Cu. St.	10	St.	60	St.	n e	8	e	6	e	4	65	47	.....	.....	.....	.....
20	St.	00	.....	00	.....	s e	1	s	4	s	8	76	54	.....	.....	.....	.....
40	Cir.Cu.	100	Cu. St.	100	Cu. St.	s w	1	s	4	s w	8	81	64	3 p. m.	.....	.....	.....
30	Cu.	80	Cu. St.	100	Cu. St.	s w	1	w	16	w	16	73	46	.....	3 p. m.	.80	.....
90	Cu. St.	10	St.	00	.....	n w	8	e	4	----	0	68	50	.....	.....	.....	.....
60	Cu.	60	Cir. St.	100	St.	s w	12	s w	12	s	8	74	57	.....	.....	.....	.....
100	Cu. St.	30	Cu.	100	Cu. St.	s	8	s w	12	w	6	76	59	8 a. m.	10 p. m.	.85	.....
30	Cu.	70	Cu. St.	100	St.	s w	8	w	8	w	8	79	68	.....	.....	.....	.....
10	St.	10	Cu.	00	.....	w	8	w	12	----	0	86	58	.....	.....	.....	.....
00	.....	20	Cir.	10	Cir.	w	3	s w	4	----	0	87	63	.....	.....	.....	.....
30	Cir.Cu.	10	Cir.Cu.	30	Cir.	----	0	w	4	----	0	92	67	.....	.....	.....	.....
50	Cir.Cu.	50	Cir.Cu.	40	Cir.	w	3	e	4	----	0	91	66	.....	.....	.....	.....
40	Cir.	10	Cu.	30	Cir.	e	3	s e	5	s e	3	91	62	.....	.....	.....	.....
10	Cir.	50	Cir. St.	100	St.	----	0	s	4	s	4	92	66	.....	.....	.....	.....
20	St.	20	Cu.	70	St.	s	8	s w	8	s	4	89	68	3 a. m.	4 a. m.	.45	.....
5	Cir.	10	Cir. St.	100	St.	s	6	w	8	----	0	86	68	.....	.....	.....	.....
100	Nim.	50	Cu. St.	100	Nim.	w	2	w	2	w	4	86	65	4 a. m.	10 p. m.	.15	.....
10	Cu.	20	Cu.	10	St.	w	4	w	16	w	1	84	62	.....	.....	.....	.....
100	Cu. St.	90	Cu. St.	10	St.	w	2	s	8	----	0	75	56	8 a. m.	3 p. m.	.33	.....
100	Cu. St.	20	Cu.	30	St.	n	3	n	2	e	3	70	50	.....	.....	.....	.....
100	Cu. St.	100	Nim.	100	Nim.	e	2	e	4	n e	4	70	54	2 p. m.	10 p. m.	.25	.....
100	Nim.	100	Cu. St.	100	Cu. St.	n e	2	n	3	n	5	67	54	.....	.....	.....	.....
100	Cu. St.	60	Cu.	00	.....	n e	3	n e	3	----	0	70	56	.....	.....	.....	.....
00	.....	20	Cir.	60	.....	s w	6	w	6	w	4	83	59	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	2.51	.....
46	.....	43	.....	43	.....	----	----	----	----	----	----	77.47	56.40	.....	.....	.....	.....
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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	68	76	64	69½	60	38	73	.411	.336	.433	29.195	29.208	29.205	29.203
2	62	79	67	69½	77	47	74	.429	.465	.489	29.233	29.155	29.148	29.245
3	71	87	77	78½	66	55	77	.503	.705	.717	29.151	29.081	29.079	29.087
4	75	86	76	79	77	61	78	.666	.762	.652	29.058	29 069	29.087	29.055
5	72	88	72	77½	76	39	71	.595	.504	.559	29 092	29.117	29.134	29.114
6	67	76	73	72	84	73	90	.556	.652	.732	29.175	29.105	29.092	29.124
7	72	83	68	74½	90	43	79	.706	.483	.543	29.135	29.107	29.125	29.122
8	58	70	66	64⅝	100	85	95	483	.599	.604	29.165	29.077	29.087	29.100
9	63	66	60	63	94	79	94	.543	.502	.487	29.072	29.095	29.045	29.071
10	61	79	67	69	88	51	79	473	.501	.522	29.080	29.062	29.047	29.063
11	73	87	79	79½	80	49	74	.631	.628	.731	28.997	28.906	28.959	28.954
12	62	54	55	57	67	87	93	.370	.362	.405	28.925	28.938	29.050	28.971
13	53	70	55	59½	86	52	93	.348	.367	.405	29.125	29.238	29.228	29.197
14	56	75	65	65½	87	43	73	.391	.363	.451	29.274	29.245	29.268	29.262
15	63	76	63	67½	62	33	78	.356	.287	.446	29.296	29.265	29.243	29.268
16	58	82	67	69	82	33	50	.394	.355	.333	29.256	29.220	29.185	29.220
17	63	81	74	72⅝	78	52	63	.446	.547	.532	29.153	29.052	29.047	29.084
18	68	83	65	72	90	37	89	.612	.410	.549	29.085	29.012	29.042	29.080
19	64	75	62	67	78	52	72	.484	.440	.367	29.092	29.102	29.175	29.123
20	60	78	64	67½	82	46	78	.426	.443	.464	29.241	29.240	29.241	29.241
21	65	83	72	73½	78	37	71	.483	.410	.559	29.238	29.159	29.148	29.180
22	68	77	65	70	84	69	94	.577	.639	.583	29.105	29.100	29.125	29.110
23	66	87	67	73½	95	31	74	.604	.393	.489	29.132	29.087	29.138	29.119
24	62	82	65	69⅝	83	30	68	.460	.322	.420	29.221	29.172	29.203	29.199
25	60	83	68	70½	77	37	79	.396	.410	.543	29.251	29.192	29.168	29.204
26	64	69	67	66⅝	100	95	100	.576	.671	.662	29.140	29.090	29.075	29.102
27	65	74	63	67½	100	72	89	.618	.604	.510	29.135	29.180	29.208	29.173
28	60	81	69	73½	94	45	70	.487	.474	.496	29.251	29.220	29.223	29.231
29	73	86	73	74	63	45	72	.510	.557	.581	29.203	29.179	29.172	29.185
30	70	89	74	74½	75	41	81	.551	.556	.630	29.160	29.076	29.087	29.091
31	73	83	78	78	76	67	69	.617	.759	.664	29.052	29.002	29.029	29.028
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	.....	.....	.....	70.53	82	52	79	.505	.500	.536	.....	.....	.....	29.119
Average	.....					71			.514		.....			

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JULY, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
10	Cir.	30	Cir.	90	St.	e	4	e	3	e	3	79	58	.....	.....	.....	.....
10	Cir.Cu.	10	St.	00	.....	s e	8	s e	8	s e	6	80	60	.....	.....	.....	.....
00	.....	10	Cu.	00	.....	s w	8	s	8	s w	5	90	70	.....	.....	.....	.....
60	Cu.	50	Cu.	80	Cir.Cu.	s w	8	w	8	w	2	88	67	.....	.....	.....	.....
30	Cir. St.	10	Cu.	00	.....	n	4	n	5	n	4	88	58	.....	.....	.....	.....
10	Cir.Cu.	100	Cu. St.	00	.....	s e	4	w	6	....	0	80	66	.....	.....	.....	.....
100	Cu. St.	10	Cu.	10	Cu. St.	e	4	n w	4	n	5	83	54	.....	.....	.....	.....
100	Nim.	100	Cu. St.	100	Cu. St.	s w	2	s	4	e	1	73	57	5 a. m.	8 p. m.	1.40	.....
100	Cu. St.	100	Cu. St.	00	.....	n e	1	e	4	n e	3	69	50	.....	.....	.....	.....
00	.....	20	Cu.	10	Cu. St.	n w	2	w	3	w	3	81	60	.....	.....	.....	.....
00	.....	10	Cir.	90	Cu. St.	s w	2	w	8	w	6	87	60	.....	.....	.....	.....
100	St.	100	Cu. St.	00	.....	e	1	e	2	e	1	62	47	.....	.....	.....	.....
40	Cir. St.	40	Cir.Cu.	00	.....	n	3	n e	3	....	0	72	48	.....	.....	.....	.....
90	St.	50	Cir.Cu.	100	St.	n	1	n e	2	e	1	76	48	.....	.....	.....	.....
Ha	zy.	00	.....	00	.....	e	2	n e	2	....	0	78	49	.....	.....	.....	.....
Smo	ky.	00	.....	30	St.	....	0	s e	3	e	1	83	58	.....	.....	.....	.....
90	Cir.Cu.	70	Cir.Cu.	100	St.	e	3	s w	8	w	3	84	62	.....	.....	.....	.....
100	Cir.Cu.	70	Cu. St.	10	Cu. St.	w	6	w	8	....	0	85	56	4 p. m.	6 p. m.	.10	.....
00	.....	80	Cu. St.	00	.....	w	5	w	6	n	2	83	50	.....	.....	.....	.....
00	.....	20	Cu.	00	.....	n	4	w	5	...	0	81	49	.....	.....	.....	.....
00	.....	80	Cu. St.	100	St.	w	4	s w	8	....	0	83	63	In nig	ht.	.10	.....
00	.....	90	Cu. St.	00	.....	w	8	n	6	....	0	78	58	.....	.....	.....	.....
10	St.	20	Cu.	20	Cu.	w	2	w	8	n	6	89	48	.....	.....	.....	.....
00	.....	20	Cu.	00	.....	....	0	w	4	....	0	85	49	.....	.....	.....	.....
00	.....	30	Cu.	100	Nim.	n w	4	n w	4	w	3	86	58	8 p. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Cu. St.	s	2	s	4	....	0	70	62	.....	6 p. m.	.67	.....
100	St.	50	Cu.	00	.....	s e	2	n e	4	n	2	76	52	.....	.....	.....	.....
40	Cir.Cu.	80	Cu.	10	St.	n e	2	s e	2	....	0	83	57	.....	.....	.....	.....
10	Cu. St.	30	Cir.Cu.	100	St.	e	2	s e	2	s	3	87	63	.....	.....	.....	.....
50	Cir.Cu.	60	Cu.	20	St.	s e	5	w	8	....	0	90	68	.....	.....	.....	.....
100	Nim.	20	Cu.	100	St.	s w	4	s w	8	e	4	84	53	7 a. m.	10 a. m.	.13	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	2.40	.....
43	.....	47	.....	88	.....	....	....	....	....	....	....	81.06	56.71	.....	.....	.....	.....
		43															

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	59	78	60	65⅝	70	38	77	.352	.356	.396	29.178	29.175	29.165	29.173
2	68	69	66	66	78	80	89	.446	.564	.570	29.188	29.171	29.087	29.149
3	73	86	75	78	90	65	90	.732	.805	.785	28.997	28.909	28.917	28.941
4	74	83	69	75½	90	64	85	.758	.717	.599	28.924	28.917	28.977	28.939
5	68	82	72	74	74	52	80	.509	.572	.631	29.022	28.999	28.967	28.996
6	70	72	72	71½	90	90	85	.658	.706	.668	28.955	28.880	28.917	28.917
7	65	75	65	68½	94	77	84	.583	.666	.516	29.017	29.007	28.950	28.991
8	67	77	56	66⅝	89	46	75	.591	.422	.336	28.908	28.944	29.092	28.981
9	55	71	57	61	81	41	63	.349	.309	.295	29.218	29.251	29.298	29.256
10	52	70	58	60	86	44	88	.334	.323	.423	29.394	29.396	29.404	29.398
11	59	69	59	62½	82	61	88	.410	.430	.489	29.371	29.353	29.348	29.357
12	57	61	53	57	94	82	86	.436	.442	.348	29.316	29.276	29.276	29.289
13	49	73	53	58½	96	43	86	.322	.345	.348	29.318	29.251	29.208	29.259
14	55	79	64	66	87	42	89	.376	.430	.529	29.194	29.094	29.107	29.132
15	66	76	70	70⅝	79	73	85	.502	.652	.621	29.065	29.042	29.047	29.058
16	78	87	71	78⅝	73	52	80	.704	.664	.608	29.044	28.999	29.080	29.024
17	72	79	67	72⅝	76	54	84	.595	.587	.556	29.062	29.092	29.145	29.100
18	68	75	56	66½	90	44	81	.612	.382	.368	29.176	29.143	29.171	29.163
19	69	82	67	72⅝	61	46	79	.430	.497	.522	29.156	29.120	29.143	29.140
20	69	79	69	72½	61	47	70	.430	.465	.496	29.171	29.107	29.045	29.108
21	69	78	62	69⅝	80	61	67	.564	.588	.370	28.875	28.840	29.032	28.916
22	58	68	51	59	64	51	86	.309	.349	.321	29.234	29.246	29.298	29.259
23	51	76	62	63	79	40	67	.296	.360	.370	29.342	29.255	29 238	29.278
24	62	80	65	69	77	37	68	.429	.382	.420	29.204	29.102	29.107	29.138
25	60	86	69	71⅝	77	30	61	.396	.371	.430	29.098	29.062	29.080	29.087
26	72	90	73	78½	67	41	76	.524	.582	.617	29.027	29.027	29.082	29.045
27	58	72	56	62	82	49	69	.394	.371	.308	29.265	29.283	29.286	29.245
28	45	77	55	59	100	27	68	.300	.243	.295	29.316	29.195	29.161	29.224
29	56	83	66	68½	63	46	79	.282	.520	.502	29.076	29.002	28.975	29.018
30	56	86	68	70	100	48	84	.449	.596	.577	28.988	28.952	28.927	28.956
31	64	63	55	60⅝	89	78	81	.529	.446	.349	28.960	29.020	29.080	29.020
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	.....	.....	.....	67 55	81	53	79	.471	.487	.471	.....	.....	.....	29.108
Average	.....					71			.476		.....			

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AUGUST, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
10	Cir.	5	Cir.	00	.....	n	4	n	3	n	1	78	53	.....	.....	.....	.....
90	Cu. St.	100	Nim.	100	St.	n	1	n	12	se	6	72	61	8 a. m.	9 p. m.	.60	.....
100	Cu. St.	70	Cu. St.	100	St.	s w	8	s w	12	s w	4	86	69	12 m.	1 p. m.	.22	.....
50	Cu.	50	Cu.	00	.....	s w	4	w	4	n	2	84	57	.....	.....	.....	.....
00	.....	20	Cu.	80	St.	n	2	n	2	e	4	82	64	.....	.....	.....	.....
30	Cir.Cu.	100	Nim.	80	Cu. St.	s w	2	s w	12	w	4	82	60	10 a. m.	4 p. m.	.25	.....
30	Cir.	100	Nim.	100	St.	w	2	w	6	se	8	80	61	1 p. m.	4 p. m.	.05	.....
100	Cu. St.	20	Cu.	00	.....	s w	8	w	12	w	2	77	46	.....	.....	.....	.....
00	.....	10	Cu.	00	.....	w	8	s w	12	w	4	71	42	.....	.....	.....	.....
20	Cir.Cu.	90	Cu. St.	100	St.	w	4	n e	2	n e	1	71	51	.....	.....	.....	.....
90	Cu. St.	90	Cu. St.	100	Nim.	n e	1	n	4	n e	4	70	54	9 p. m.	5 a. m.	.70	.....
100	Cu. St.	100	Cu. St.	00	.....	n	3	n	3	n	1	65	42	.....	.....	.....	.....
00	.....	20	Cu.	00	.....	....	0	w	4	....	0	75	48	.....	.....	.....	.....
10	St.	10	Cir.	100	Nim.	w	8	s w	8	s w	1	79	54	7 p. m.	9 p. m.	.05	.....
100	Cu. St.	100	Cu St.	....	.....	s w	6	s w	4	....	0	78	65	.....	.....	.....	.....
70	Cu. St.	50	Cu.	30	Cu.	s w	1	s w	1	s w	1	87	68	.....	.....	.....	.....
20	Cu. St.	30	Cu.	50	Cir. St.	s w	1	w	1	n w	2	88	62	.....	.....	.....	.....
30	Cir.Cu.	20	Cir.Cu.	00	.....	n w	2	n w	4	....	0	79	54	.....	.....	.....	.....
00	.....	30	Cu.	90	Cir. St.	s w	3	s w	3	....	0	84	63	.....	.....	.....	.....
50	Cir. St.	10	Cir. St.	80	Cir. St.	s e	1	s e	4	....	0	80	65	.....	.....	.....	.....
90	Cir. St.	100	Cir. St.	90	Cir. St.	s e	1	n	3	n e	2	80	56	.....	.....	.....	.....
00	.....	00	.....	00	.....	n	4	n	6	....	0	70	38	.....	.....	.....	.....
10	Cir.Cu.	10	Cir.	00	.....	n	4	w	12	w	8	76	50	.....	.....	.....	.....
00	.....	00	.....	00	.....	s w	8	w	6	w	4	80	54	.....	.....	.....	.....
00	.....	00	.....	00	.....	s w	8	s w	12	w	2	87	59	.....	.....	.....	.....
00	.....	20	Cir.	10	Cir.	s w	12	w	16	n e	2	90	56	.....	.....	.....	.....
100	St.	00	.....	00	.....	n e	8	n	6	n	1	73	36	.....	.....	.....	.....
100	Fog.	00	.....	00	.....	n	1	n e	1	....	0	77	43	.....	.....	.....	.....
30	Cir.Cu.	70	Cir.Cu.	00	.....	s w	6	w	2	w	1	84	52	.....	.....	.....	.....
100	Fog.	30	Cu.	00	.....	w	1	n w	8	w	1	86	50	.....	.....	.....	.....
100	Fog.	100	Cu.	00	.....	n	8	n	3	n	1	66	34	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	1.87	.....
44	.....	44	.....	37	.....	....	....	....	....	....	....	78.58	53.94	.....	.....	.....	.....
				42													

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	46	71	56	57⅞	84	36	63	.262	.263	.283	29.138	29.120	29.141	29.133
2	59	77	60	65⅛	65	42	77	.323	.389	.396	29.177	29.245	29.243	29.222
3	55	85	65	68⅛	87	29	58	.376	.350	.359	29.261	29.192	29.122	29.192
4	56	74	54	61⅛	75	63	67	.336	.532	.282	29.058	29.067	29.246	29.127
5	42	68	51	53⅜	100	34	65	.267	.232	.245	29.359	29.369	29.418	29.382
6	41	72	55	56	91	23	50	.235	.179	.218	29.439	29.414	29.401	29.418
7	56	81	63	66⅜	81	45	83	.363	.474	.478	29.339	29.221	29.141	29.234
8	63	81	63	69	94	28	57	.543	.283	.327	29.033	29.002	29.067	29.034
9	63	76	57	65⅛	72	27	69	.416	.243	.322	29.075	29.067	29.100	29.081
10	50	82	63	66⅜	79	26	42	.283	.270	.290	29.181	29.183	29.171	29.178
11	63	88	75	75⅛	57	26	56	.327	.344	.484	29.156	29.150	29.047	29.118
12	57	70	48	58⅛	69	32	78	.322	.234	.236	29.092	29.092	29.196	29.127
13	45	66	47	52⅜	76	32	77	.228	.208	.249	29.256	29.194	29.251	29.234
14	32	74	57	54⅛	100	22	52	.181	.181	.242	29.282	29.206	29.133	29.207
15	53	80	63	65⅛	80	34	89	.321	.349	.510	29.045	28.945	28.912	28.967
16	60	62	56	59⅛	100	83	94	.518	.460	.420	28.762	28.712	28.885	28.786
17	54	63	55	57⅛	87	62	100	.362	.356	.433	28.953	28.985	29.033	28.990
18	56	58	54	56	75	76	100	.336	.365	.418	29.065	29.095	29.133	29.098
19	54	64	52	56⅜	87	58	93	.362	.343	.361	29.159	29.135	29.178	29.154
20	45	67	56	56	100	60	94	.300	.393	.420	29.206	29.181	29.208	29.198
21	48	70	49	55⅝	93	53	93	.310	.385	.322	29.259	29.120	29.201	29.227
22	47	68	56	57	100	60	87	.323	.411	.391	29.338	29.316	29.348	29.331
23	53	67	58	59⅛	93	60	82	.375	.393	.394	29.454	29.421	29.386	29.420
24	45	74	55	58	100	40	87	.300	.331	.376	29.396	29.271	29.236	29.298
25	45	62	55	54	100	88	100	.300	.491	.433	29.005	28.898	28.878	28.927
26	45	52	48	48⅛	92	86	92	.289	.334	.310	28.831	28.673	28.691	28.732
27	48	52	43	47⅝	78	60	92	.260	.232	.254	28.778	29.003	29.156	28.976
28	37	47	40	41⅛	90	70	91	.199	.225	.225	29.217	29.254	29.301	29.257
29	38	50	39	42⅛	91	58	91	.208	.210	.216	29.330	29.284	29.258	29.291
30	47	49	47	47⅝	62	78	92	.202	.272	.298	29.039	28.940	28.728	28.902
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	.....	.....	.....	57.76	85	50	79	.318	.324	.340	.....	.....	.....	29.128
Averages						71			.327					

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SEPTEMBER, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
90	Cu. St.	00	.....	10	.....	n e	2	w	6	w	1	62	42	.....	.....	.....	.....
00	.....	80	Cu.	00	.....	w	3	n w	5	....	0	80	45	.....	.....	.....	.....
00	.....	40	Cu.	00	.....	e	2	s e	4	s	4	85	51	.....	.....	.....	.....
00	.....	70	Cu. St.	00	.....	s e	4	w	6	n e	5	76	38	11 a. m.	12 m.	.10	.....
00	.....	00	.....	00	.....	n	4	e	5	n e	1	68	35	.....	.....	.....	.....
00	.....	00	.....	00	.....	n e	3	e	6	e	1	72	41	.....	.....	.....	.....
60	Cir. St.	20	Cir Cu.	100	St.	s e	7	s e	12	s	8	82	54	In ni	ght.	.11	.....
00	.....	10	Cu.	00	.....	s w	8	w	12	w	1	81	47	.....	.....	.....	.....
00	.....	10	Cu.	00	.....	w	6	w	12	....	0	76	49	.....	.....	.....	.....
00	.....	10	Cu. St.	60	St.	w	2	s w	5	w	8	82	53	.....	.....	.....	.....
80	Cu. St.	20	Cu.	80	Cu. St.	s w	6	w	12	s w	8	88	55	.....	.....	.....	.....
00	.....	60	Cu.	20	St.	w	12	n w	8	n	1	72	34	.....	.....	.....	.....
00	.....	00	.....	00	.....	n w	1	w	6	....	0	70	32	.....	.....	.....	.....
100	Fog.	00	.....	00	.....	....	0	s	6	s e	5	74	32	.....	.....	.....	.....
00	.....	70	Cu. St.	100	Cu.	....	0	s e	12	w	2	80	54	6 p. m.	.....	.....	.....
100	Cu. St.	90	Cu.	90	Cu.	n w	1	w	12	s	5	62	50	.....	7 p. m.	.96	.....
10	Cu.	100	Cu. St.	100	Nim.	s	6	s e	8	s w	4	67	53	7 p. m.	10 p. m.	.10	.....
50	Cu.	100	Cu. St.	80	Cu. St.	s w	8	s w	8	s w	4	58	50	3 p. m.	8 p. m.	.20	.....
90	Cu. St.	50	Cu.	00	.....	s	6	w	8	....	0	64	42	.....	.....	.....	.....
100	Fog.	70	Cu.	50	St.	....	0	n w	4	n w	1	70	44	.....	.....	.....	.....
80	St.	50	Cir.Cu.	100	St.	n w	2	n e	3	e	1	71	42	.....	.....	.....	.....
100	Fog.	30	Cu.	00	.....	e	1	n e	3	n e	2	68	47	.....	.....	.....	.....
100	Cu. St.	30	Cu.	00	.....	n e	2	n e	3	n	1	67	44	.....	.....	.....	.....
100	Fog.	00	.....	00	.....	....	0	s e	5	s e	1	75	43	.....	.....	.....	.....
00	.....	100	Nim.	100	Nim.	....	0	s	3	n e	5	72	42	1 p. m.	.....	.....	.....
40	Cir. St.	100	Nim.	30	Cu. St.	w	6	s w	12	s w	6	57	44	.....	7 p. m.	.30	.....
90	Cu. St.	100	Cu. St.	40	St.	n w	12	n w	8	w	1	52	32	.....	.....	.....	.....
100	St.	100	Cu. St.	100	St.	n w	1	w	3	w	2	50	35	.....	.....	.....	.....
10	St.	80	Cu. St.	30	St.	w	2	n w	2	w	1	52	38	.....	.....	.....	.....
100	St.	100	Nim.	100	Nim.	s w	1	s w	2	s w	3	56	46	1 p. m.	10 p. m.	.12	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	1.89	.....
45	.....	50	.....	39	.....	----	----	----	----	----	----	69.97	43.63	.....	.....	.....	.....
45																	

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	53	63	47	54½	80	52	77	.363	.455	.249	28.494	28.534	28.702	28.577
2	39	42	36	39	82	50	61	.195	.134	.129	28.931	29.068	29.133	29.041
3	36	40	38	38	61	65	72	.129	.160	.165	29.175	29.177	29.100	29.151
4	42	64	53	53	66	39	67	.177	.177	.269	29.025	28.892	28.918	28.945
5	49	49	43	47	85	100	100	.297	.297	.278	29.008	29.047	29.082	29.046
6	41	57	44	47½	91	58	92	.235	.268	.265	29.055	29.008	29.004	29.022
7	47	58	48	51	92	58	93	.298	.282	.310	28.898	28.825	28.912	28.878
8	47	53	36	45½	85	54	90	.278	.219	.191	29.025	29.088	29.125	29.063
9	28	51	36	38½	100	65	80	.153	.245	.170	29.153	29.141	29.135	29.143
10	28	61	38	42½	100	31	81	.158	.164	.186	29.186	29.156	29.128	29.153
11	34	52	45	43⅝	90	47	68	.175	.183	.204	29.108	29.040	28.940	29.028
12	42	45	41	42⅝	100	100	100	.267	.300	.257	28.762	28.685	28.715	28.721
13	43	49	46	46	100	93	92	.278	.322	.286	28.757	28.887	28.997	28.864
14	43	58	48	49⅝	100	48	78	.278	.229	.260	29.150	29.138	29.130	29.139
15	45	48	45	46	92	100	100	.275	.335	.300	29.042	28.988	28.885	28.955
16	45	55	45	48½	84	50	68	.251	.218	.204	28.835	28.858	28.907	28.863
17	37	48	45	43½	90	70	76	.199	.236	.228	29.110	29.201	29.258	29.190
18	38	48	45	43⅝	91	70	84	.208	.225	.278	29.338	29.185	29.131	29.235
19	50	48	41	46½	86	49	57	.309	.165	.147	28.842	28.868	28.920	28.877
20	35	41	36	37½	90	57	53	.183	.147	.115	28.990	29.128	29.263	29.127
21	32	38	35	35	69	54	70	.125	.123	.142	29.447	29.431	29.383	29.420
22	35	43	41	39⅝	100	92	91	.204	.254	.235	29.339	29.163	29.087	29.196
23	41	43	40	41½	100	92	82	.257	.254	.208	28.992	28.938	28.968	28.966
24	32	56	49	47⅝	81	57	71	.186	.255	.247	29.088	29.078	29.090	29.085
25	41	65	50	52	74	44	93	.190	.272	.385	29.156	29.098	29.083	29.109
26	51	55	53	53	93	93	100	.348	.405	.403	29.045	28.998	28.925	28.989
27	52	62	48	54	100	61	70	.388	.340	.236	28.842	28.875	28.945	28.887
28	41	46	40	42½	82	54	73	.212	.169	.182	29.025	29.100	29.163	29.096
29	40	56	36	44	82	40	80	.203	.179	.170	29.025	29.012	29.258	29.098
30	30	52	45	42½	100	35	61	.167	.136	.182	29.376	29.284	29.172	29.277
31	53	73	62	62⅝	54	81	46	.219	.655	.256	29.078	29.072	29.112	29.087
Sums	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	.....	.....	.....	45.70	87	68	78	.232	.252	.229	.....	.....	.....	29.027
Average	.....					76			.238		.....			

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OCTOBER, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
60	St.	80	Cu. St.	100	Cu. St.	s w	5	w	16	n	12	65	39	.....	.....	.....	.....
100	Cu. St.	90	Cu. St.	100	St.	n	4	n	4	n	3	42	28	.....	.....	.....	.....
100	St.	100	St.	20	St.	n	1	s w	3	s w	4	43	34	.....	.....	.....	.....
100	Cu. St.	70	Cu. St.	50	St.	s w	2	s w	12	s w	5	63	42	.....	.....	.....	.....
100	Cu. St.	100	Nim.	100	Nim.	n e	2	n e	2	n e	3	49	41	1 p. m.	12 p. m.	.40	.....
100	Cu. St.	80	Cir.Cu.	00	.....	n e	5	n	4	n	2	58	41	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	00	.....	s w	4	n w	5	....	0	58	44	4 p. m.	6 p. m.	.10	.....
100	Cu. St.	80	Cu.	20	St.	n	2	n	5	n e	1	58	26	.....	.....	.....	.....
00	.....	00	.....	00	.....	n	3	n w	6	w	1	51	27	.....	.....	.....	.....
00	.....	00	.....	10	St.	....	0	w	2	....	0	61	28	.....	.....	.....	.....
100	St.	100	St.	100	St.	n	1	n e	2	n	3	53	34	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	n	3	n e	4	n e	2	45	41	7 a. m.	.....	.....	.....
100	Nim.	100	Nim.	90	St.	n	3	n	3	n	2	49	43	.....	3 p. m.	.30	.....
100	St.	70	Cu.	100	Cu. St.	n	1	w	4	....	0	58	42	.....	.....	.....	.....
100	Cu. St.	100	Nim.	100	Nim.	s e	4	s e	3	s w	7	48	43	8 a. m.	10 p. m.	.20	.....
70	Cu.	40	Cu.	00	.....	s w	8	s w	20	w	3	56	36	.....	.....	.....	.....
50	Cir.Cu.	100	Cu. St.	90	Cu.	w	5	w	12	n w	1	48	37	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	Cu.	n	2	s e	8	s e	12	50	38	5 p. m.	.....	.....	.....
100	Cu. St.	20	Cu.	100	Cu. St.	w	16	w	20	w	12	50	34	.....	5 a. m.	1.34	.....
00	.....	100	Cu. St.	100	Cu. St.	w	8	n w	12	n	2	41	30	.....	.....	.....	.....
100	Cu. St.	100	Cu. St.	100	St.	n	1	n	5	n e	4	38	32	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Cu. St.	e	6	s e	2	e	1	43	35	7 a. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Cu. St.	w	4	s w	7	s w	2	43	36	.....	7 p. m.	.11	.....
70	Cu. St.	60	Cir.Cu.	00	.....	s w	8	s w	20	s w	12	56	37	.....	.....	.....	.....
10	St.	00	.....	00	.....	s	5	s e	9	s e	8	65	41	.....	.....	.....	.....
90	St.	100	Cu. St.	100	Nim.	s e	7	s e	6	s	2	55	51	4 p. m.	.....	.....	.....
100	Nim.	80	Cu. St.	70	Cu. St.	w	4	s w	4	w	3	62	36	.....	8 p. m.	.55	.....
60	Cu. St.	90	Cu. St.	50	St.	s w	5	w	7	n w	4	47	38	.....	.....	.....	.....
80	St.	20	Cu.	00	.....	w	8	n w	12	n	8	58	30	.....	.....	.....	.....
70	Cir.Cu.	10	Cir.Cu.	20	St.	....	0	s	8	s w	8	53	30	.....	.....	.....	.....
60	Cu. St.	10	Cir. St.	100	St.	s w	12	s w	16	s w	8	73	53	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	.....	.....	.....	.....	3.00	.....
78	.....	69	.....	62	.....	----	----	----	----	----	----	52.84	37.00	.....	.....	.....	.....
				70													

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	56	74	65	65	63	36	54	.232	.300	.330	29.186	29.143	29.052	29.127
2	64	61	59	61½	78	88	88	.464	.473	.439	28.892	28.852	28.982	28.909
3	36	56	39	43⅓	100	40	91	.212	.179	.216	29.102	29.150	29.208	29.153
4	45	62	49	52	76	36	85	.228	.202	.297	29.063	29.075	29.052	29.070
5	49	65	63	59	78	63	100	.272	.389	.576	29.055	28.948	28.850	28.951
6	45	43	38	42	84	75	81	.251	.209	.186	28.952	29.020	29.117	29.030
7	27	46	40	37⅓	88	54	82	.129	.169	.208	29.252	29.243	29.251	29.249
8	38	43	40	40½	100	100	100	.229	.278	.267	29.061	28.998	28.992	29.017
9	41	42	41	41⅓	91	91	91	.235	.244	.235	28.911	28.950	28.798	28.886
10	42	43	35	40	74	75	80	.199	.209	.162	28.698	28.612	28.868	28.724
11	35	45	35	38⅓	70	58	80	.142	.160	.162	29.156	29.135	29.171	29.154
12	31	52	37	40	100	41	61	.174	.159	.178	29.239	29.286	29.321	29.282
13	34	56	43	44⅓	79	39	59	.155	.168	.164	29.415	29.344	29.303	29.354
14	43	61	45	49⅔	75	50	84	.209	.269	.251	29.276	29.169	29.133	29.193
15	44	56	38	46	100	75	91	.289	.336	.208	29.005	28.858	28.960	28.941
16	25	36	30	30½	100	71	78	.135	.149	.130	29.140	29.106	29.135	29.127
17	22	27	20	23	86	100	100	.101	.147	.108	29.449	29.483	29.548	29.493
18	26	32	32	30	100	100	100	.141	.181	.181	29.442	29.304	29.226	29.324
19	31	40	31	34	100	73	69	.174	.173	.118	29.323	29.391	29.511	29.408
20	16	30	18	21½	100	78	100	.090	.130	.098	29.631	29.661	29.648	29.647
21	17	34	20	23⅔	100	70	100	.094	.138	.106	29.592	29.514	29.518	29.541
22	15	38	31	28	100	72	89	.086	.165	.155	29.537	29.561	29.558	29.552
23	25	42	32	33	100	42	79	.135	.113	.143	29.500	29.434	29.418	29.451
24	26	39	35	33½	100	64	70	.141	.152	.142	29.400	29.433	29.485	29.439
25	31	41	30	34	89	49	89	.155	.126	.148	29.511	29.448	29.341	29.433
26	30	35	33	32⅔	78	61	89	.130	.127	.168	29.234	29.117	29.057	29.136
27	28	32	30	30	100	79	100	.153	.143	.167	28.985	28.925	28.942	28.951
28	28	35	33	32	100	100	100	.153	.204	.188	28.978	28.922	28.960	28.963
29	33	37	36	35½	109	90	100	.188	.199	.212	28.961	28.905	28.933	28.933
30	36	35	30	33⅓	100	70	78	.212	.142	.130	28.953	28.958	29.016	28.976
31														
Sums														
Means				38.50	90	69	86	.185	.201	.202				29.167
Average						82			.196					

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NOVEMBER, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
90	St.	90	Cir. St.	100	St.	s w	7	s w	16	s w	24	72	56	.....	.....	.....	.....
100	Nim.	100	Nim.	100	St.	s w	16	s w	12	w	12	64	36	7 a. m.	5 p. m.	.15	.....
00	.....	00	.....	10	St.	n w	5	w	12	w	2	56	32	.....	.....	.....	.....
80	St.	90	St.	100	St.	s w	8	s w	12	s w	8	62	45	.....	.....	.....	.....
90	St.	100	Nim.	100	Nim.	s w	6	s w	4	s w	3	65	45	2 p. m.	12 p. m.	.40	.....
100	Cu. St.	100	Cu. St.	00	.....	n w	8	w	16	w	1	43	26	.....	.....	.....	.....
40	Cu. St.	90	Cu. St.	100	Cu. St.	.....	0	e	8	n e	6	46	27	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	e	5	n e	8	n e	12	43	39	1 a. m.	10 p. m.	1.70	.....
100	Nim.	100	Cu. St.	100	St.	n e	1	n e	8	n	7	42	40	In night.		.35	.....
100	Cu. St.	100	Nim.	100	Cu. St.	s w	8	s w	16	w	20	43	35	11 a. m.	5 p. m.	.10	.....
50	St.	80	Cu. St.	00	.....	w	12	s w	12	s w	8	45	30	.....	.....	.....	.....
00	.....	10	St.	15	St.	.....	0	s w	6	s w	2	52	31	.....	.....	.....	.....
10	St.	10	St.	20	St.	.....	0	s w	12	s w	8	56	34	.....	.....	.....	.....
50	St.	80	Cu. St.	50	St.	s w	6	s w	12	s w	3	61	40	.....	.....	.....	.....
70	St.	90	Cu. St.	100	St.	s w	4	s w	8	w	16	58	25	.....	.....	.....	.....
70	St.	80	Cu.	100	Cu. St.	n w	4	w	16	s w	12	36	20	In night.		.05	⅛
40	St.	80	St.	50	Hazy.	n w	5	w	1	w	1	29	19	.....	.....	.....	.....
70	Cu. St.	100	Cu.	100	Cu.	e	2	n e	5	.....	0	32	26	11 a. m.	.....	.....	.....
00	.....	00	.....	00	.....	n e	1	n w	4	n	2	41	15	In night.		.25	2½
00	.....	00	.....	00	.....	n	2	n	4	n e	3	30	14	.....	.....	.....	.....
80	St.	10	St.	00	.....	.....	0	n e	1	.....	0	36	13	.....	.....	.....	.....
10	St.	80	Cu.	100	Cu. St.	n	1	n e	2	n e	3	39	15	.....	.....	.....	.....
00	.....	00	.....	10	St.	e	1	s	1	s	2	42	25	.....	.....	.....	.....
10	St.	100	St.	100	St.	s	1	n e	5	n e	3	43	26	.....	.....	.....	.....
10	St.	80	Cu.	10	St.	n	2	e	4	n e	2	42	25	.....	.....	.....	.....
90	Cu. St.	80	Cu. St.	100	St.	n	1	n	4	n	3	35	27	.....	.....	.....	.....
100	St.	100	St.	100	Nim.	n w	1	n	4	.....	0	32	28	3 p. m.	10 p. m.	.06	¼
100	St.	100	St.	100	St.	n	1	n	2	n	1	35	28	.....	.....	.....	.....
100	St.	100	St.	100	Nim.	n w	2	n w	6	n w	3	40	33	6 p. m.	.....	.....	.....
100	Nim.	100	St.	100	St.	n w	2	n w	7	n w	5	39	28	.....	10 a. m.	.06	.....
----	.....	----	.....	----	.....	----	----	---	----	----	----	-----	-----	.....	.....	.....	.....
----	.....	----	.....	----	.....	----	----	----	----	----	----	-----	-----	.....	.....	3.12	3¼
59	.....	61	.....	66	.....	----	----	----	----	----	----	45.30	29.43	.....	.....	.....	.....
				62													

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METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	29	30	29	32½	89	64	89	.142	.153	.142	29.063	29.151	29.175	29.136
2	31	30	30	30½	79	89	89	.136	.148	.148	29.143	29.146	29.151	29.147
3	32	34	30	32	100	79	78	.131	.155	.130	29.087	29.088	29.077	29.087
4	26	40	32	32½	100	82	100	.141	.208	.181	29.007	28.718	28.682	28.801
5	33	33	30	32	89	89	89	.168	.168	.148	28.672	28.752	29.127	28.850
6	29	34	29	30½	89	79	100	.142	.155	.160	29.240	29.193	29.156	29.196
7	32	43	32	35½	89	59	89	.163	.164	.163	29.017	28.998	29.057	29.024
8	34	38	35	35½	79	81	90	.155	.186	.183	29.065	29.042	29.045	29.051
9	32	38	33	34½	89	72	89	.162	.165	.168	29.136	29.074	29.075	29.094
10	32	41	32	35	89	74	79	.162	.190	.143	28.998	28.915	28.952	28.955
11	30	35	25	30	78	61	87	.130	.127	.117	28.962	28.989	29.115	29.089
12	23	27	26	25½	86	64	75	.106	.093	.105	29.085	29.102	29.087	29.071
13	9	25	16	16½	100	75	100	.065	.100	.090	29.223	29.350	29.310	29.294
14	14	29	26	23	100	89	100	.083	.142	.141	29.498	29.450	29.374	29.441
15	29	37	41	35½	100	81	49	.160	.178	.126	29.138	29.021	28.958	29.039
16	40	43	44	42½	100	100	100	.248	.278	.289	28.745	28.662	28.634	28.680
17	30	26	20	25½	100	100	100	.167	.141	.108	28.752	28.777	28.845	28.791
18	16	21	17	18	83	71	83	.074	.080	.078	28.874	28.980	29.087	28.947
19	13	22	20	18½	100	86	86	.078	.101	.091	29.145	29.312	29.325	29.261
20	25	30	30	28½	75	68	68	.100	.111	.111	29.265	29.011	28.951	29.142
21	19	23	13	18½	69	60	81	.071	.078	.063	29.148	29.333	29.445	29.309
22	15	28	27	23½	82	66	76	.070	.099	.111	29.446	29.362	29.148	29.319
23	31	50	42	41	89	58	66	.155	.210	.177	29.212	29.151	29.169	29.177
24	39	41	45	41½	64	91	84	.152	.235	.251	29.151	29.105	29.095	29.117
25	46	38	35	37½	92	91	90	.286	.208	.196	29.050	29.150	29.048	29.083
26	35	50	38	41	90	79	81	.196	.283	.186	28.974	28.602	28.565	28.714
27	27	33	28	29½	76	79	77	.111	.150	.117	28.655	28.733	28.968	28.792
28	25	29	28	25½	75	67	86	.100	.105	.106	29.138	29.181	29.232	29.184
29	25	28	21	24½	87	77	100	.117	.117	.113	29.396	29.401	29.421	29.406
30	28	36	34	32½	77	61	79	.117	.129	.155	29.356	29.306	29.201	29.301
31	35	31	27	31	90	69	100	.183	.118	.147	29.178	29.211	29.251	29.213
Sums														
Means				30.39	87	76	86	.139	.154	.143				29.070
Average						83			.145					

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DECEMBER, 1888, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7. A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
95	St.	10	Cu.	10	St.	w	2	w	6	s w	6	40	28	.....	.....	.....	.....
100	St.	100	St.	100	St.	s w	8	s w	6	s w	2	35	30	.....	.....	.....	.....
100	St.	100	St.	100	St.	s w	2	s w	12	s w	8	34	25	.....	.....	.....	.....
30	St.	90	St.	00	.....	s w	6	s w	20	w	8	40	26	.....	.....	.....	.....
100	St.	100	Nim.	100	Nim.	w	1	n w	8	n e	8	33	28	8 a. m.	9 p. m.	.10	½
100	St.	100	St.	00	.....	n	4	s w	8	s w	8	34	28	.....	.....	.....	.....
30	St.	70	Cir. St.	70	St.	s w	12	w	8	w	1	44	30	.....	.....	.....	.....
100	St.	100	St.	100	St.	....	0	s e	2	s	4	38	32	.....	.....	.....	.....
100	St.	100	St.	00	.....	n e	2	s	5	s w	5	40	30	.....	.....	.....	.....
100	St.	70	Cir.Cu.	40	Cir.Cu.	s	6	s w	12	w	5	41	30	.....	.....	.....	.....
10	St.	30	Cu.	90	St.	n w	6	n w	5	n w	5	37	21	.....	.....	.....	.....
100	St.	100	St.	100	St.	n w	3	n w	8	n w	6	27	9	In	night	.05	½
10	St.	10	Cu.	00	.....	n	2	n w	8	n	5	25	9	.....	.....	.....	.....
10	St.	20	St.	100	St.	n w	12	s	8	s	4	29	14	.....	.....	.....	.....
90	St.	100	Nim.	100	Nim.	s	3	s w	16	s	12	40	29	1 p. m.	.....	.....	.....
100	Nim.	100	Nim.	100	Nim.	s	3	s w	8	s w	7	44	30	.....	.....	.50	.....
100	Nim.	100	Nim.	100	Nim.	n e	8	n	8	n	7	30	15	.....	.....	.10	.....
100	Nim.	90	Cu. St.	70	St.	n	6	n w	5	n w	4	21	12	.....	11 a. m.	.....	1
50	St.	50	Cu.	80	St.	n	4	n	3	n	1	25	13	.....	.....	.....	.....
100	St.	70	St.	100	St.	s w	12	s w	16	s w	20	32	19	.....	.....	.....	.....
40	Cu.	10	St.	00	.....	n	12	n	8	....	0	24	11	.....	.....	.....	.....
80	St.	60	Cu. St.	00	.....	s	3	s w	15	s w	12	31	15	.....	.....	.....	.....
10	St.	40	Cir.Cu.	00	.....	s w	12	s w	12	s	16	52	32	.....	.....	.....	.....
30	St.	100	Nim.	100	Nim.	s w	12	s w	16	s w	12	47	39	1 p. m.	.....	.....	.....
100	Nim.	100	St.	100	Nim.	s w	3	w	5	e	1	46	33	.....	.....	.20	.....
100	Nim.	100	Nim.	100	St.	e	4	s e	12	s w	24	50	27	.....	5 p. m.	.25	¼
100	Nim.	100	Nim.	80	St.	s w	24	w	20	w	8	33	24	.....	.....	.....	.....
100	St.	30	Cir. St.	100	St.	w	12	w	12	w	3	29	22	.....	.....	.....	.....
100	St.	90	Cu. St.	00	.....	s w	5	s w	6	....	0	28	21	.....	.....	.....	.....
60	Cir. St.	100	Cu. St.	100	St.	s w	2	s w	4	s w	2	36	28	.....	.....	.....	.....
100	Nim.	100	Cu. St.	100	St.	w	2	n w	4	w	2	35	22	.....	.....	.....	.....
....	.....	....	.....	....	.....	....	....	....	....	....	....	.....	.....	.....	.....	1.20	2¼
76	.....	75	.....	66	.....	....	....	....	....	....	....	36.48	23.61	.....	.....	.....	.....
			72														

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VI. TILE DRAINING IN RELATION TO FLOOD AND DROUGHT.

The soil supply of water for crops is so intimately related to plant growth that any cause capable of seriously disturbing the supply of soil water through the growing season should be regarded with concern. The condition of the water in the soil has an important bearing on the subject. Water held by capillarity in the soil is better suited to supply the plant than free water, which will flow under the action of gravity.

Drainage may have for its object the removal of surface water of ponds and marshes (ditches), or the removal of excess of water in the soil (tile draining). The removal of stagnant surface water from marshes and bogs by ditching is sanctioned by the great mass of intelligent farmers; to replace a foul swamp by a rich meadow meets with just approval. Not only is the useful area of the farm increased, but the general health is promoted. By the government surveys about one-ninth of the lower peninsula of Michigan was returned as swamp land. By a system of county and town drainage provided by State law, and by appropriations of swamp lands for extended systems of drainage, these swamp lands have been reclaimed in large portions of our State, and with such manifest benefit to the public health that three-fourths of the malarial diseases that prevailed in our State prior to such swamp drainage have been driven from our borders. The benefit, both to the farmer and the people at large, is so pronounced that a proposition to return these rich meadows to reeking swamps, with the attendant fevers and suffering, would receive small encouragement from any class. Our people prefer the harvest gathered by a Buckeye reaper, rather than that of the skeleton reaper with his invisible scythe.

Yet the gain from this system of surface drainage is not an unmixed good. Every deviation from nature's plan seems to bring in its train retribution in some form. The ready and rapid flow of surface water by open ditches augments the flood at times of thaw or heavy rains; and, by diminishing the area of evaporation, makes the air more arid in times of drought. These results are inseparable from free drainage by open ditches. So far as I have observed the open ditches make the floods more severe, they come more suddenly, rise higher and subside quicker than in the olden time before the swamps were drained, and while the face of the country was mostly covered with forests. These alternations of flood and drought are the joint results of ditching and deforesting. Yet the good secured so far overbalances the incident evil that no return to the primeval condition is to be expected in our State. We simply accept the fugitive evil as the price for the permanent good.

Some writers in the agricultural press aver that tile draining increases the evils of open-ditch drainage, that "the 95,000 miles of tile drains in Illinois, and perhaps a third as much in length of open ditches, together with a proportionate measure of both in Iowa and Indiana, have reduced these States to the natural condition of Kansas by removal of all surplus surface water, * * * affording creeks dry beds six months in the year, lowering the well water level twenty feet in twenty-five years, partially suppressing the origin of summer thunderstorms, and, in short, changing the climate and surface aspect of the country in course of settlement dating back not more than 50 years quite as much as 500 years of similar excesses have done for the middle and south of Europe."

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This is not a cheerful picture. How far tile draining has contributed to such results demands thoughtful consideration. I cannot speak from personal knowledge of the conditions relating to soil water in the States named, but an intimate acquaintance with the country around the Michigan State Agricultural College for twenty-five years, during which time a large amount of tile drains have been laid and many swamps ditched, enables me to say that no such depression of the well water level has taken place in my neighborhood, and that the well water level has remained essentially the same during the whole period. I have not been able to learn of any such marked lowering of the water table in other portions of our State.

Ex-Governor Porter, of Indiana, in addressing the American Public Health Association in 1882, said: "It gives me pleasure also to say that the practice of underdraining the soil has in this State been found so greatly to increase its productiveness that, in proportion to the area of the State, it is said we have more underdrained soil than any of the States. Underdrainage has everywhere been followed by a great lessening of sickness; and intermittent fever, once so common, has become so rare that it is a good deal less prevalent than in some of the oldest States."

The general proposition that tile draining increases flood and aggravates drought, demands careful consideration.

Flood.

The common time of special danger from flood in the level States at the north is when the accumulated snows of winter rapidly thaw, especially with warm rain, and while the ground is still frozen and thus impervious to the accumulating water. The depth of frozen soil varies widely in the same neighborhood. On the 18th of February, 1888, when the ground was, for the most part, covered with snow which was rapidly melting, I explored the soil by boring with a long-shanked auger to determine how deeply the soil remained frozen. The passage from frozen to free soil was almost as marked as when boring through a plank. In a porous sandy soil which had been covered with snow all winter, and was still covered with two inches of snow, the ground was frozen 19 inches; in a clay soil near by, which had been blown bare of snow repeatedly and was still uncovered, the frozen soil was 24 inches deep; in a sheltered garden where 10 inches of snow still remained, the frozen soil was 8 inches; in a forest where snow was not drifted by the wind, and the covering of snow and forest leaves remained undisturbed, the frost line averaged 2 inches, while in an open field in the lee of the forest the frost line extended 15 inches. These measurements were all taken the same day.

When the surface soil is impervious to water it is manifestly a matter of indifference, so far as water is concerned, whether the subsoil is tiled or not. The surface water cannot reach the tile drain, and no flood flow of water can come from such tile drains. Yet we find our worst floods with a frozen surface soil. The water can only flow over the surface, and with a deforested country there is little to obstruct such flow, and the danger of flood is great.

But in the warmer seasons of the year we occasionally have very heavy rainfalls and disastrous floods as the result. Do tile drains increase these floods?

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The action of a tile drain may be continuous or intermittent; when continuous it is usually the discharge of some spring; when intermittent it is the usual action of a drain in carrying off the excess of rainfall beyond what the soil can hold as capillary water, or else the redundant accumulation of soil-water by the indirect action of frost. How long will it take water to percolate through three feet of soil to reach an ordinary tile drain? The time required will depend upon the kind and porosity of the soil, and upon the amount of water already in the soil. If the soil is saturated with water, the addition of water at the top will cause almost immediate flow at the bottom, but none will flow till the soil contains all the water it can hold by capillary action.

Not having at hand the desired data in regard to the passage of water through soil, I made some investigations on this subject, and was fortunate to have the means at hand to verify certain points by means of a large balance made for the Experiment Station by Becker Brothers, of New York. By actual trial, I find that when this balance is loaded with 5,000 grammes in each scale-pan, the balance will turn with one-tenth of a milligramme. A balance that will turn with one fifty-millionth of its load is sufficiently delicate for such investigations.

A number of tin tubes 2 inches in diameter and 20 inches long, part of them closed water-tight at one end, and others closed at one end by perforated tin, were used for the experiment. The tubes were carefully weighed and marked; then filled with sifted air-dry soil, and again weighed; then placed in a vertical position and water added till water began to flow from the perforated end of the tube, when the time was noted that was required for percolation, and when the flood ceased the tubes were again weighed. This gave data for the weight of dry soil, the time for percolation of water through 18 inches of dry soil, and the weight of water taken up by dry soil and held by capillary attraction. The tubes with closed ends gave similar data, except that the time of percolation could not be so accurately determined.

Two kinds of soil were used, a garden soil of sandy loam, and road dust, with considerable clay. The tubes were used in duplicate with both kinds of soil. The weight of the dry garden soil as compared with water, volume for volume, was 148 to 100; that of the road dust was 173 to 100.

In the perforated tubes with garden soil (air dry), the vertical column of water required to thoroughly wet 36 inches of soil was 12½ inches, and the time required was 20 hours, and the water retained in the capillary condition was 23.47 per cent of the weight of the soil. With the road dust the time required to thoroughly wet the road dust was 24 hours, and the water held by capillary action was 18.25 per cent of dry soil. It was difficult to determine the exact time when the water reached the bottom of the closed tubes, but as far as could be discovered the time was about two hours longer than in the perforated tube, the air enclosed in the tube escaping only by bubbling up through the water, while in the perforated tube it had free escape at the bottom. That this soil in closed tubes held free water soon after it had all sunk away from the surface was shown by the fact that the percentage of water was increased from 23.47 per cent to 26 per cent.

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Percolation in Damp Soils.

The time required for water to flow through air-dry soil, and the quantity required to wet them is hardly a fair test, because we never find 35 inches depth of such dry soils in lands used for farming in this climate. After the soil in these tubes had been thoroughly wet, the tubes were left freely exposed to the air in a room, well ventilated, for 33 days of hot and drying weather. Evaporation could only take place at the top of the closed tubes, representing a soil where only surface evaporation is possible, while evaporation could freely take place in the perforated tubes from both top and bottom, representing in an exaggerated degree a tiled field.

At the close of this "drought" of 33 days the tubes were again weighed to determine the loss of water by evaporation and the amount still retained in the soil. The following table exhibits the results:

Loss by Evaporation from Drained and Undrained Soils.

Air Dry Soil in	Average Weight of Water Retained by Soil.		Evaporation. Grammes.
	At Beginning of 33 Days' Drought. Grammes.	At End of 33 Days' Drought. Grammes.	
Open tubes	322.43	223.76	99.67
Closed tubes	358.15	288.80	69.35

On drenching these soils it was found that the moist garden soils in perforated tubes required 4.45 inches in vertical column of water to saturate them, and the average time for water to percolate through 36 inches of this moist soil was 9½ hours; while the soils in the closed tubes required for saturation a vertical column of 2.35 inches, and 11 hours time. It will be noted that soils in the closed tubes required only about half as much water to wet them down as the soils in the perforated tubes, though it required a longer time. The rapidity with which a drained soil takes up the rain when it falls after a dry spell is not to be overlooked in discussing tile-draining. This singular fact came out in these experiments that at the second wetting of these soils after 33 days of dry weather as regards the soil in the tubes, the drained soils absorbed and retained by capillary action an average of 34.47 grammes (or .67 inch vertical column) more water than at the first wetting of the air-dry soil, while the soils in the closed tubes could not take up as much water by capillary action as at the first wetting, the loss of capillary power being 8.57 grammes (.17 inch vertical column of water). It thus appears in this experiment that the underdrained soil has an increase of 12.6 per cent of capillary power over the soil destitute of drainage. The draining and the non-draining of the soils in these experimental tubes are both in exaggerated form. But even if we estimate this increase of absorptive power in a tile-drained field at only one-third of the amount found in these tube experiments, this will enable the tiled field to take up and retain after a dry spell, one-fifth of an inch of rainfall more than the field destitute of drainage, in case of copious rainfall that comes in a short

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period. Any of you who have measured rainfalls will know that .22 inch of rain is a very respectable shower. This increased water-holding power of tile-drained soils is of great importance, and is not to be overlooked in discussing the effects of tile-draining. The influence of draining is often regarded simply as removing water; but the secondary influence upon the soil, even if the tile is dry for half the year, is of equal importance with water removal. The conservative influence of underdraining by this increased capacity to hold water when it suddenly comes and is in danger of running off by surface flow, is one of the benefits to be considered.

Some have attempted to explain the fact that a tile-drained field will endure drought better than one not drained, by claiming that the air circulating through the tiles gives up moisture to the soil, but I think a better explanation is the increased power of the drained soil to hold water in capillary form, and perhaps also from its greater power to draw up water from the deeper soil by capillary action.

Time of Flow of Field Drains.

Such observations as I have been able to make on the time of beginning of the flow of water in tile drains after the commencement of a storm conforms in some degree to the results of experiments already given. Except when the ground is fully saturated with water, as in the thaw of spring, when the water accumulated by the action of frost is rapidly set free, there is a sensible interval of time after the rain begins to fall before the tile-flow sets in. In many rains the tiles do not discharge at all in summer because the increased capacity to hold water enables the soil to absorb all the rain. In the majority of cases when the tiles give a flow it is only after 12 to 24 hours—in most cases about 16—after the storm has begun. By the time the tiles begin to discharge the storm usually begins to break away, and the action of the tile is to prevent flood, instead of augmenting it. Where a flood is caused by excessive rainfall or a "cloud-burst," the flood is caused by the water flowing over the ground and not through it. The great floods that have devastated portions of our country have occurred in regions where tile-draining is almost unknown. Take the floods in West Virginia and around Pittsburg as examples. Some of you may recall the dreadful flood that swept Alleghany City in July, 1874. I visited the scene a few days after and while the marks of the destroyer were not effaced. A sudden and very heavy rain had fallen on the neighboring hills, the water by converging valleys was poured upon the city, the nine foot sewer became obstructed, and the water rose 25 feet in the streets in as many minutes, and the destruction of life and property was awful. Yet in all the track of that storm there were not two miles of tile drains, and if there had been a hundred miles the flood would not have increased in violence thereby.

I think the opponents of tile draining will find some difficulty in pointing out regions where tile draining has been extensively carried on, where destructive floods are especially injurious, and to find other localities similarly situated, except in the matter of tile draining, where floods are never known.

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Conclusions.

From these investigations I arrive at these conclusions:

1. Surface ditching in conjunction with deforesting may increase floods and contribute to droughts.

2. Tile draining may increase flood at the "break-up" in spring when the water accumulated in the surface soil by the joint action of frost and soil capillarity during the winter, and the surface accumulations in the form of snow are suddenly set free by a rapid thaw.

3. During the warm months tile draining tends to mitigate flood by taking up the excessive rainfall and holding it in a capillary form, keeping back the sudden flow that would pass over the surface of the soil if not absorbed by it, and escape by flood; and mitigating summer drought by increased capacity of the soil to hold water in capillary form, and to draw upon the subsoil water supply by reason of the increased capillary power of such soil produced by tile draining.

VII. ENSILAGE.

The subject of ensilage has assumed such importance both with the farmer and the stock-grower, that anything connected with it will command their attention. So much Indian corn is raised for this purpose that it is a matter of interest to know at what period of growth to cut the corn so as to get the best results in the silo, and also to find the relative composition and food value of the stalks cut at any given time, and the ensilage made from the same.

An investigation bearing on this subject was undertaken in 1888, and the results, as far as anything decisive was reached, were given in Bulletin No. 49. But this work was not satisfactory, mainly because the untimely frost put a stop to the work before the field of corn assigned for the experiment had reached such maturity as the investigation contemplated, viz.: from tasseling of the corn to complete ripeness of the grain. It was therefore decided to repeat the experiment in 1889, following essentially the same plan as in 1888. The experiment began on the 10th day of August, the corn on a measured plat of ground being cut, weighed carefully, a portion being reserved to determine the amount of solid matter per acre, and for analysis, and the rest placed in a small silo. This was repeated at periods of about six days till the corn stalks were fully ripe, seven specimens of fodder and ensilage having been secured in this way. When the ensilage is ripe, the material will be analyzed and the results of both sets of analysis—of the corn stalks and of the ensilage—will be given in a future bulletin. The excessive drought of this season will disturb the investigation to some degree, but it is hoped the results will yet be of real value to the farmer and stock feeder.

VIII. MISCELLANEOUS ANALYSES.

A variety of materials come to this department for analysis, and the results of such investigations are often of interest, and sometimes of profit to our people.

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Marsh Grass.

Persons in different parts of the State have requested information in regard to the fodder value of the "marsh grasses" that grow so abundantly in some parts of our State. A very good specimen of this marsh hay was obtained for analysis. The grass was cut in good season and before the development of a strong silicious covering, or dense woody fibre. Hon. A. C. Glidden, who furnished the hay, says that it was relished by sheep, who kept in good condition with the marsh hay as principal food. The marsh hay, as received, gave the following results on analysis:

Water, per cent	7.86
Ash	4.20
Crude fibre (woody)	27.55
Albuminoids (crude protein)	7.00
Ether extract (fat, etc.)	3.60
Carbohydrates (nitrogen free extract)	49.79
	100.

These analytical results of marsh hay compare very favorably with those of timothy hay. There is little doubt but that many kinds of the so-called swamp grasses, if cut at the proper season and properly cured, will furnish very valuable fodder. The proportion of digestible matter is larger than commonly supposed.

Reindeer Moss.

As a mere curiosity to our people, the analysis of reindeer moss is here presented. The moss grows in only a few localities in our State, and is probably not used by any animals in our State. The specimen analyzed was found at Port Sandfield, in the Muskoka region of Canada. Its appearance was so unpromising as a fodder that some of it was brought home for analysis, which gave the following surprising results:

Moisture (driven off at boiling heat)	14.25
Dry matter	85.75
	100.

The dry matter gave the following:

Crude fibre (woody matter) per cent	17.95
Ash	1.29
Crude protein (albuminoids)	4.10
Ether extract (fat, etc.)	2.11
Carbohydrates (nitrogen free extract)	74.55
	100.

The proportion of albuminoids is small, but the digestible carbohydrates belonging to the starch and gum class are relatively large.

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Wheat Screenings.

The value of immature grains, screenings, etc., does not seem to be properly recognized. Shrunken and imperfect grains that give little promise of valuable results in milling, are usually regarded as equally valueless for cattle food. The nitrogenous portions of food are the most costly and most valuable in animal food. Their most valuable quality, aside from direct food value, is the fact that they enable the animal to digest and assimilate a larger amount of the coarser carbonaceous foods that would fail to be appropriated by the animal in the absence of a sufficient supply of nitrogenous food or albuminoids.

In an extended investigation into the composition of wheat cut at different periods of ripening, made in this laboratory in 1880, published in the report of the State Board of Agriculture in 1881 and in volume IX. of the census of the United States for 1880, it was shown that the relative proportion of nitrogenous materials in wheat was much larger in the early period of growth of the kernel, and rapidly fell off as the period of complete ripening came forward. A part of this nitrogenous material was in the form of amides, the food value of which is not well settled, though all writers concede that they are valuable; still the value of a given weight of such immature grain as compared with the same weight of the same grain at complete ripening was much larger.

Mr. G. S. Pearson, of Kalamazoo, sent two samples of wheat screenings to be analyzed in order to determine their value for stock food. The screenings consisted largely of shrunken and immature grains of wheat, some broken kernels, chess, seeds of weeds, chaff, etc.

Analysis of Wheat Screenings.

	No. 1.	No. 2.
Water	7.80	8.40
Ash	3.80	3.76
Crude fibre (woody matter)	4.95	6.10
Albuminoids	12.53	13.38
Amides	2.25	1.68
Ether extract (fat, etc.)	2.65	3.03
Carbohydrates (starch, gum, sugar, etc.)	66.02	63.65
	100.00	100.00

Wheat Bran, Etc.

Specimens of feeding stuff were received from Geo. L. Sheldon, of Climax, for analysis. No. 1 was described as "a sample of bran, or rather it is the germ of the wheat separated from the rest, and reground." No. 2 is wheat bran. Mr. Sheldon says No. 1 is "generally run into coarse middlings, and sold as such. Almost any roller mill can separate it out. I can buy it for

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$11 a ton, bran the same, and fine middlings at $14." The analysis is given as affording information concerning the coarse products of roller mills:

	No. 1.	No. 2.
Water	12.76	8.96
Dry matter	89.24	91.04
Composition of Dry Matter:	100.00	100.00
Ash	6.74	6.83
Crude fibre (woody matter)	8.94	8.51
Albuminoids	17.55	17.30
Ether extract (fat, etc.)	4.80	5.16
Carbohydrates (starch, sugar, etc.)	61.97	62.20
	100.00	100.00

These materials, in the dry form, agree closely in composition.

Sugar Beets.

The project of raising sugar beets on the "stump lands" from which the pine timber has been removed, has often been brought to our attention, but no one has made trial on a sufficient scale till this year. A short time ago the following letter was received relating to this subject:

TAWAS CITY, *Oct. 14, 1889.*

Prof. Kedzie:

DEAR SIR—Some of my countrymen have been experimenting with German sugar beets and have requested me to ask you if you would analyze the beets and find the percentage of sugar they contain. They believe that this northern country is well adapted to growing sugar beets, and if so it would be a great benefit to the farmers here. The specimens grown are very good, especially for the season past, and if you could analyze them and be reasonably sure that it would pay, more would be planted and efforts made towards starting a sugar factory. Hoping that you will take interest in the matter as you always have in anything that would be a benefit to the public, I remain

Yours respectfully,

GEO. C. ANSCHUETZ.

A reply was immediately sent back that the analysis would be made, since the Experiment Station was established for such work, and asking for full information in regard to the kind of soil, method of cultivating, and the product to the acre. A parcel of beets and the following letter soon came to hand:

TAWAS CITY, *Oct. 23, 1889.*

R. C. Kedzie, Chemist of Experiment Station:

DEAR SIR—Yours of the 16th inst. at hand, and in reply will say that we will send by express a package of one lot of German sugar beets—seed

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imported from Germany—and one lot of American sugar beets, each lot properly labeled.

In answer to how they were grown and on what kind of soil, I would say that the American sugar beet was grown on red clay, planted on pine stump land that had never been cultivated or manured. Before the seed was planted the ground was hoed, and after the beets came up they were hoed to keep the weeds down; that was all the cultivation they received.

The German sugar beet was grown on sand with clay subsoil two feet below the surface. The ground had been plowed four times—once in each season; no manure used, nor had it been manured previously.

The selection sent is of medium size; larger and smaller specimens were grown on the same soil. The smallest would contain more sugar than mediums or larger: that is why mediums were chosen.

I also give you an outline of how they are grown in Germany and on what principles a sugar plant is run.

1. The ground on which sugar beets are grown in Germany is sandy, or high clay land. Low land is not used for growing the beet. It is claimed that on low land the beets grow larger, but contain less sugar. The year before the beets are grown the land is heavily manured with stable manure and a crop of barley or other grain taken off. The ground is then very deeply plowed and seeds sown in drills 14 inches apart, and plants thinned to 14 inches in a row, and hoed about three times during the season. If the beets tend to grow out of the ground they are covered to the leaves. (You will find the specimens sent are trimmed of all that grew above the ground. All the portion trimmed off is of no use to the sugar manufacturer, and is fed to cattle by the grower.)

2. The sugar plant in Germany is mostly owned by the farmers and run on the same principle as a bank or other organization, each stockholder agreeing to grow a certain amount of beets, delivering them in the fall to the factory and receiving so much a ton for his beets. All the refuse of his beets is returned to him and used for fertilizers, and no other fertilizers are allowed. Any stockholder using fertilizers or freshly manured ground is subject to a fine of $50, and for a second offense he is expelled from the organization. Beets are grown every three years on the same ground, and an acre will average about ten tons.

This information is from parties that have grown the beet in Germany and worked in the plant. They believe that the beet can be successfully grown here, and if so, it would be a great benefit to this part of Michigan. We have a good harbor and railroads, and plaster which is used in cleaning the sugar. * * * * Any farther information as far as I can obtain it will be cheerfully given.

Respectfully yours,

GEO. C. ANSCHUETZ.

The roots, as received, were well developed and fair in appearance. A quantity of each kind was cut into very thin slices, weighed and then dried to constant weight in an air-bath at 212° F., and the weight of original substance, the loss by drying and the weight of dry residue, the per cent of dry matter and of water was determined. Each kind of beet was grated to a fine pulp, and the juice extracted by a filter press; the specific gravity of the juice taken, the quantity of sugar in the juice estimated by the saccha-

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rometer to give the *apparent* sugar present, and then the clarified juice tested for glucose by Fehling's test, and finally the sugar in the juice estimated by polarized light. The following table gives the results of such examination.

	German Sugar Beet.	American Sugar Beet.
Average weight of beets, in ounces	21	16
Total solids on evaporation, per cent	19.00	22.7
Water, loss by evaporation, per cent	81.00	77.3
Specific gravity of the juice	107.26	108.24
Apparent per cent of sugar by saccharometer	15.10	18.20
Glucose, by Fehling's test	traces	traces
Cane sugar in juice by polarization	14.14	15.22
Cane sugar in whole beet, per cent	12.78	13.40

Beets that contain 12 to 13 per cent of crystalizable sugar are worthy of consideration and compare favorably with German and French sugar beets. While sugar beets require a soil of good quality for full development, it may be found that much of the land from which the pine has been removed for lumber will afford good crops of beets. The sandy soil would probably furnish roots rich in sugar. The ease with which such crop could be raised on this sandy soil, and the ability of the beet to withstand frost and drought make this crop an interesting if not a promising one for many districts in our State. There is no question about the value of these beets for feeding stock.

ANALYSIS OF SUGAR BEETS FROM OTHER LOCALITIES.

Five specimens of sugar beets grown the past season were sent to me for analysis by Hon. E. W. Cottrell—three from the farm of Hon. T. W. Palmer. The results of analyses are presented to show the capacity of beets grown in this State to produce sugar and that the climate is suited to the formation of sugar.

No. 1—Seed imported from Germany, a cross of vilurorin and imperial beets, per cent sugar, 14.58.

No. 2—Sugar beets, grown without manure, per cent sugar, 11.40.

No. 3—Manured with 200 pounds superphosphates and 200 pounds nitrate of soda per acre, per cent sugar, 11.40.

No. 4—Beets raised by Mr. Klein of Oakland county, per cent sugar, 12.12.

No. 5—Beets raised in Livingston county, per cent sugar, 7.86.

All of these beets except No. 5 contain sugar in quantity that would pay for manufacturing purposes. A beautiful specimen of sugar was made from No. 2 of this series, and can be seen in the Museum of the Chemical Laboratory.

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In carrying out these analyses, and in the laboratory work in this department, I am under great obligations to my faithful assistant, Mr. Geo. L. Teller.

Respectfully submitted,

R. C. KEDZIE,

Chemist of Experiment Station.

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REPORT OF THE ENTOMOLOGICAL DEPARTMENT.

President O. Clute, Director Experiment Station:

DEAR SIR—I submit the following report of the work done in the Entomological and Apiarian Departments of the Experiment Station for the year ending June 30, 1889:

At the beginning of the season I submitted the following scheme of work for the year, which was accepted by the "advisory board" of the station:

"In the Entomological Department, experiments with the arsenites in hopes to find what substance is least injurious to foliage, and what may be the influence of date of application and atmospheric conditions on the amount of injury wrought; to continue the experiments with the arsenites and carbolized plaster as remedies for the plum curculio; to carefully investigate the matter of pasturing or feeding grass growing under trees at the time they are sprayed with the arsenites, London purple or Paris green, that we may know positively the danger incurred in such practices; to investigate the ravages of the several flea beetles; Haltica Chalybea Ill., Crepidodera Cucumeris Harr., and Phyllotreta vittata Fab., and if possible find a satisfactory remedy for each and all; to investigate the matter of growing potatoes, to determine what relation there may be between insect attack and scab; and to give attention to such other insects as may from their numbers or ravages give cause for anxiety or alarm.

"In the apiarian division of our work it was proposed to experiment with the following honey plants: Rocky Mountain bee plant (*Cleome integrifolia*) Chapman honey plant (*Echinops sphærocephalus*), and a species of Melissa; to determine the wisdom or unwisdom of special planting of all or any of these plants solely for bees; to again sow the Japanese buckwheat, to further study its prolificness, its value as a honey plant, and its power to resist drought, and to mature a good quality of seed even though sown early or late; to continue our careful cross-breeding of bees; to arrange for analyses of various kinds of honey; and to investigate and observe such matters of practical manipulation and management as may be suggested during the season."

EXPERIMENTS WITH THE ARSENITES.

Quite elaborate experiments were performed with London purple, Paris green and common white arsenic. The details of these experiments, together with the results, were embodied in a paper read before the "Society for the

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Promotion of Agricultural Science" at the Toronto meeting, and printed and distributed as Bulletin 53 of this Station. So important are the conclusions deduced from these experiments that I will briefly state them here:

First—Early spraying seems less harmful to foliage than does later. Spraying in May rarely does harm, while the same in June or July, even with a more dilute application, is often a serious damage.

Second—There seems to be no essential difference as to the time of day. Spraying early in the morning, at noontide, or towards night-fall, each seemed about as the others, as to injury produced on the foliage.

Third—A rain soon after spraying increases the damage to the foliage, especially if we use London purple or white arsenic.

Fourth—London purple is more injurious to tender or susceptible foliage than is Paris green, while white arsenic is more injurious than is London purple.

Fifth—White arsenic should never be used in such warfare. London purple may be used on all trees, except the peach, early in the season, in May, but never stronger than one pound to two hundred gallons of water. If used on shade trees or on plum trees in June and July the proportions should be one pound to three hundred gallons of water. For peach trees, Paris green only should be used, and this not stronger than one pound to two hundred, and possibly three hundred gallons of water. And for all trees late in the season, June and July, it is much safer to use Paris green than to use London purple. Probably it is the soluble arsenic that does the mischief, and this is likely to be present in considerable quantities in London purple, while it is nearly absent in Paris green.

Sixth—There seems no danger in turning stock into an orchard immediately after it has been sprayed with the arsenites. If properly sprayed—that is, sprayed with a dilute mixture as suggested above—the amount of poison which falls to the grass below, and which would be eaten, even if all the herbage was cropped by the stock, would be far too slight to do any harm. Chemical analysis, as well as direct experiment with horses, sheep and hogs, determines this question beyond any chance of error.

FIGHTING THE CURCULIO.

This year, as last, we sprayed our plum trees with London purple, and dusted them with carbolized plaster. We used one pound of London purple to two hundred gallons of water, and mixed one pint of strong, crude carbolic acid with fifty pounds of common land plaster. As last year, so this, we repeated each application twice, making three times in all. The results this year were very different from those of last year. Trees treated, like those untreated, lost every plum. This year we had hard rains almost every day. These doubtless so washed off the poison or plaster that they were no preventive of the work of the beetles. My experiments last year, together with those of Prof. C. M. Weed, of the Ohio station, in 1888 and 1889, and those of Prof. S. A. Forbes, of Illinois, show quite conclusively that the arsenites will prevent in great part the work of the curculio if we can keep the poison on the leaves and fruit. The same is true of carbolized plaster. But my experiments this season prove that in very rainy seasons the old jarring method is not only cheaper, but the only effective method yet known.

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As suggested last year, the curculio prefers plums to apples; but in the absence of the plums they will attack most ruinously the apples. Apples seriously stung by the curculio become so gnarled and deformed as to be wholly worthless. Thus it becomes imperative to the best success that plum trees be set among the trees of the apple orchard. Then we have to spray the apple trees but once to subdue the codling moth, the several leaf-rollers, the canker worm and tent caterpillars, while we can jar the plum trees, or treat them two or three times with the arsenites or carbolized plaster, as circumstances seem to recommend. The plums will save the apples, and with pains to repel the curculio, may give as good returns as any product of the farm. I believe the same course may be profitably pursued in the cherry orchard. I believe the presence of abundant plum trees will save the cherry trees from the attack of the curculio, and so we shall get cherries—if we have enough to more than supply the birds—with no effort to repel injurious insects from the cherries themselves.

THE FLEA BEETLES.

In 1888 portions of New Jersey, New York and adjacent States were seriously injured by the depredations of the cucumber flea beetle, Crepidodera cucumeris Harr. These insects attacked the potatoes.

This year we resolved to investigate all the flea beetles in our vicinity in hopes to find good practical remedies for some or all of them. We were well supplied with material, as the grape flea beetle, Haltica chalybea Illig., the striped flea beetle, Phyllotreta vitata Fab., no less than the cucumber flea beetle, Crepidodera cucumeris, were each and all abundant in our region. The first worked only on the grape, which it injures seriously, both while in the larval and mature stage. As larvæ they feed on the foliage, as imago, or mature beetles, they work early in the spring, eating the buds. The striped flea beetles work on several plants, but worst on radishes and cabbages, while the third works on many plants, but most on potatoes, tomatoes and cucumbers. We tried many remedies, such as carbolized plaster, kerosene and soap mixture, dilute carbolic acid, gas lime, tobacco decoction, buhach, hellebore, ashes, lime, tobacco dust, London purple, ashes and London purple, turpentine and plaster, etc., etc. Few of all these substances seemed to work with any satisfaction. London purple and water, one pound of the poison to two hundred gallons of water, is quick death to the grape flea beetles, and is a cheap and satisfactory remedy for the mature beetles that attack the buds of the grape in early May. The same remedy, and also the kerosene and soap mixture, are both sure destruction to the larva of this insect which later in the season eats the grape foliage. I find the following to be the best compound to use in this warfare: One quart soft soap or one-fourth pound hard soap, two quarts of hot soft water and one pint kerosene oil. Stir this thoroughly till all mix permanently, then add water till the kerosene forms only one-fifteenth part of the whole. The best way to stir is to use a force pump and pump the liquid back into the the vessel containing it. This soon mixes it so that the oil will not rise to the top upon standing.

For the other two insects we only found two remedies that seemed at all satisfactory. Ashes dusted onto the affected plants seemed to repel the insects and save the plants. Yet success in this case required that the plants

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be entirely covered with the ashes. This not infrequently injured or appeared to injure the plants. Thus, while ashes will repel these flea beetles, they are not a desirable remedy. The other specific in this case was a strong tobacco decoction. I used tobacco dust, which I got very cheaply at a large tobacco factory in Detroit. I would take two large handfuls of this dust, pour boiling water on it, then use the water or decoction to sprinkle the affected plants. I used about one pound to two gallons of water. This was used on several plants for both the cucumber and striped beetles, and seemed in every case to bring immediate relief. While this seemed either to kill or drive off these beetles, it in no wise injured the plants. We shall try this again very thoroughly another year; but we feel already warranted in recommending it to any who have occasion to fight these very destructive little hopping beetles. It seems to be just what is wanted. If as effective to rid the grape-vines of the grape flea beetle in the early spring, it might be substituted for the London purple in that warfare.

INSECTS AND POTATO SCAB.

I planted potatoes in a field where very scabby potatoes were raised last year, and also some in boxes in the laboratory, in earth in which there was no insects. Those in the field were examined often. It was very rare that any insects were found near the potatoes, and never was there found a single myriapod. The scab began to appear while the potatoes were yet very small. This is but a repetition of similar experiments tried in previous years. I much doubt if insects have anything to do with scab on potatoes. I am very positive that the millipeds, or thousand legged worms, so-called, do not cause the scab on our Michigan potatoes. I expected to get positive results in the potatoes planted in boxes and kept in the laboratory. In these boxes there were no insects, and if we had succeeded in growing scabby potatoes we should have known that scab was independent of the work of insects. Unfortunately, however, while we had a very fine growth of vines, we raised no potatoes. Thus this effort was wholly fruitless. We shall repeat this trial another year, in hopes of better success.

INSECTS OF THE YEAR.

This has been quite a remarkable year for insects. Early in the season there was a general invasion of the corn fields of the State by the cut-worms. The season was very late at best. Much corn was not planted till in June, and even then it made a very slow growth. Following this was the attack by the cut-worms. Thus in many parts of the State the corn was largely a failure. The only remedy that is practical in defending against this pest is that of baiting by bunches of poisoned herbage. I have tried this only on a small scale, but have been so successful that I feel free to recommend the method to others. The best method to pursue is as follows: While the grass or clover is still standing in some meadow, spray it thoroughly with London purple; then carefully cut with a scythe, and draw it to the infested field and pitch small forkfuls among the corn plants, so that they may be quite close together, at least not farther separated than one or two rods. Some bind the herbage in small bundles, that it may remain fresh longer. The objection to this remedy is the expense, and the binding into bundles

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makes it more laborious and expensive, while I do not believe it materially adds to its effectiveness. Some who have tried this are not satisfied that it is effective. They say that they find no dead caterpillars. The poisoned cut-worms are apt to bury slightly in the earth before they die. That they are really killed is beyond question. The time to distribute the poisoned herbage in the garden where tomatoes and cabbages are to be set is just before the plants are to be transplanted. In the corn field, in case we find by close examination that the newly plowed sward is full of the hungry caterpillars, the poisoned grass or clover may be distributed just before or soon after the corn is up. If neglected till the insects commence cutting the plants it will yet pay to try this remedy, perhaps in a small way at first, and then, if found, as will probably be the case, that it works well it may wisely be tried more extensively. That this will surely pay in garden culture is beyond question; that it may prove valuable in general field culture I think more than probable.

THE GRAIN PLANT LOUSE.

The most startling insect development during the year was that of the grain plant louse, Aphis (Siphonophora) avæna L. This was remarkable, not only in showing how an insect may develop and increase to an enormous extent under favorable circumstances, but also as vividly showing how the insect enemies of any insect may in a remarkably short space of time so increase as to overwhelm their victims, even though the latter exist in countless myriads. The leading practical facts concerning this plant louse were given in Bulletins No. 50 and 51. I will add that I experimented to learn if we could destroy the lice by use of artificial remedies, and if such remedies would prove practicable. I tried several remedies. The kerosene and soap mixture is effective if the application is thorough enough. We used a hand pump, and sprayed the wheat very thoroughly, but we found that owing to the protection which the insects received from the kernels many were not touched and so remained uninjured. As we were much more thorough than would be possible in treating a whole field, I am led to the conclusion that any such remedy would never give satisfaction. We may well rejoice that we have such efficient aids in our insect friends that we shall never need to fight these grain plant lice with artificial remedies. Not only are the artificial remedies impracticable, because of necessary lack of thoroughness, but they are also undesirable, because of the large damage that is done to the grain in their use. We cannot drive through a grain field without causing serious destruction to the crop.

A NEW CLOTHES BEETLE.

During the past summer I have received from G. D. Perrigo, Portland, Michigan, many specimens of a minute beetle and the grubs or larvæ of the same, of which I wrote the following, which was presented before the American Entomological Club at the late meeting in Toronto, Canada.

One of the most interesting studies of the scientific entomologist—more interesting because of its economic importance—relates to variation in the habits of insects consequent upon change in their environment. The carpet beetle, Anthrenus Scrophulariæ Linn., feeds on flowers in its native Europe.

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In the new atmosphere of America it feeds and thrives upon carpets, shawls and other woolen goods. The apple maggot, Trypeta pomonella Walsh, feeds upon our wild haw and other wild fruits. Civilization exterminates its old-time aliment and it betakes itself to our autumn apples, and this year I have found it on both cherries and plums. The curculio, apple-tree borers, bark lice, etc., are other illustrations of the same truth.

I have discovered the past season another illustration in the Lasioderma serricorne Fab. This insect belongs to the family Ptinidæ, a small family of very small insects. Very few of the insects of this family are noxious; the two best known of which are the apple-twig borer, Amphicerus bicaudatus Say, which in the mature state bores in the twigs of the apple tree, and Sinoxylon basilare Say, which attacks the hickory and grape. The insect in question, Losioderma serricorne Fab., has been found to attack plush furniture. The larvæ in this case do the mischief; they perforate the plush, making it like a sieve. Several pieces of valuable furniture were ruined by these minute larvæ.

Fig. 1. Beetle.

The beetle (Fig. 1) is light brown in color. The color of the entire beetle is uniform, except that the eyes and tips of the elytra are black. The wing covers appear a little lighter in color, because of a covering of light hairs, which are more dense on the elytra than on the thorax and head. The thorax bends down so as we look from above we cannot see the head. The serrate antennæ, which give name to the beetle, are also bent under the head so that they likewise rarely show. The beetles are very small, hardly more than two mm. long. The elytra are non-striated. The first two joints of the antennæ are small. The following joints increase to the sixth, and then decrease to the end. The tenth or last joint is rounded. The grubs (Fig. 2) are short, curled and hairy. They are two mm. long and one thick. The color is white, as is also the hairs, though the latter have a slightly yellowish tinge. The six thoracic legs are tipped with black. The upper part of the head is marked with four yellowish-brown lines; the upper ones are narrow, while the latter ones are abbreviated behind. The front of the head is brown; the jaws and other mouth-parts nearly black.

Fig. 2. Larva.

As these beetles are cosmopolites, and feed on various articles of commerce, even tobacco and cigars, we may well hope that this new habit will ever remain exceptional.

Like all insects, these beetles, both as grubs and mature beetles, are very susceptible to both gasoline and bisulphide of carbon. Either of these used freely were quickly fatal to the insects. Of course whenever either of these substances are used great care must be exercised that no fire be brought near till these inflammable liquids are evaporated, which, however, soon takes place. Like the carpet beetle, Anthrenus scrophulariæ Linn., so these insects infest upholstered furniture between the folds, especially where the back joins the seat. It is easy to drench such parts of a chair or sofa with gasoline and destroy the larvæ of moth or beetle.

Nearly every year brings examples of such change of habits as described above. Such incursions, present and prospective, emphasize the importance of a thoroughly trained entomologist in every State of our country.

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THE WEE GRAIN BEETLE.

Not infrequently during the past few years have I found in rice and other culinary articles, specimens of a small, slender, brown beetle, which, though probably a native of the orient, has become, from its habits, scattered throughout the habitable globe. This little beetle is known to science as Silvanus surinamensis Linn. In 1881 I received this beetle from Breedsville, Michigan, where it was found seriously injuring the wheat and other grains. In 1882 a leading merchant of Detroit sent for me to come at once to his house, as a worse than the locust plague was inflicted upon him and his household. I hastened to Detroit and found his house fairly swarming with these same wee grain beetles. The elegant house of this gentleman was, through the rear rooms, connected with the nearly as elegant barn or stables. Upon examination I found that meal and other grains were kept perpetually in these stables. Further search discovered that these beetles were breeding in this meal, and that they existed in the barn in countless thousands. As they are very small and flat they could press between casings and windows, and under windows and doors, and so had taken, all uninvited, entire possession of the house, greatly to the horror and disgust of the family. This present season Mr. D. S. Hall, of Tecumseh, Michigan, has discovered the same pest in his wheat. To show in what fabulous numbers these gather upon the fated grain, I have only to say that Mr. Hall writes that he could easily collect one-fourth bushel of these minute beetles. He actually did collect one peck in cleaning 600 bushels of grain. This explains the emigration and wide spread dispersion at Detroit.

This beetle is referred to in the Government Agricultural Report for 1870, p. 66, in a brief illustrated article. It is stated that it feeds on various grain, apple seeds, and even leaf tobacco. A brief illustrated note occurs also in the American Entomologist, vol. 2, p. 339. Here a brief description of the beetle is given. The specimens were from Pennsylvania and were reported as very destructive to wheat, rye and oats. It is also stated that it makes the grain damp and warm, which fact is always observed where these wee grain beetles are present in force. Curtis, in his Farm Insects, p. 329, gives an excellent account of this insect, which is accompanied with a fine colored figure.

Fig. 3. Beetle.

This beetle (Fig. 3) is a narrow, flat brown insect. It belongs to the family Cucujidæ. Most of the insects of this family are flat, and generally are found resting under bark, as this is also said to do. It is very small, hardly 3 mm. (.12 in.) long. The pro-thorax is a little darker than are the wing covers. The antennæ are slightly enlarged at the end. The last three joints (See fig. 3) form this enlargement. There are on the upper surface of the pro-thorax three raised longitudinal lines, and six distinct teeth on each side. There are four similar lines on each wing cover. These ridges, however, are not so prominent as those of the pro-thorax. Between the raised lines of the wing covers are double rows of pits or punctures. Smaller punctures also cover the thorax and head. The femora or thighs are all enlarged, and the tarsi are all five jointed. Fine, short, light-colored hairs cover sparingly nearly the whole of the insect.

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The grub or larva is cream colored. The head is prominent, the jaws large, and three jointed thoracic feet are plainly visible. It is a little longer than the beetle, or about 4 mm. long.

The pupa is a little shorter than the beetle. It is the same color as the larva, and has spinous projections on the sides of both the thorax and abdomen.

REMEDIES.

When these beetles are in a close box or bin, nothing is more effective to destroy them than is bisulphide of carbon. This very volatile liquid soon evaporates, and the deadly fumes are so penetrating that few beetles, even in a bin of grain, escape alive. In a bin or barrel the liquid can be applied at the bottom as follows: A piece of gas pipe, with a close fitting rod in it, is pushed into the grain. The rod is then withdrawn and the liquid poured into the pipe; after which the latter is quickly drawn out. A piece of oil cloth or a carriage robe spread over the bin or barrel to confine the vapors, aids the work. This remedy is excellent in all cases of insects that infest stored grain. There is only one objection—the danger of fire. This vapor is highly inflammable and explosive. A burning match or a lighted cigar might cause a disastrous explosion. It is to be said, however, that the vapors are soon dispersed, so that open doors and windows soon remove all danger. We see, then, that caution and a brief guarding of the premises are all that is required to remove all danger. At my suggestion one of the largest flour manufacturers of Michigan has entirely cleared one of his mills of insects, though the mill was terribly infested, by this remedy. His mill is in the very center of one of our largest cities; yet he was cautious and no danger was incurred. He buys his bisulphide of carbon by the barrel of the manufacturer at Cleveland, Ohio. Of course no one should breathe the poisonous vapors. In the case at Detroit we found that paper spread with lard or other grease would attract the beetles in prodigious numbers, when they could be easily and quickly destroyed. In this case they were so widely distributed that the bisulphide of carbon was not a practical remedy.

SQUASH BUG PARASITE.

Few of our noxious insects are more destructive or harder to combat than is the large dark colored squash bug, Anasa (Coreus) tristis De Geer. The method of trapping under chips, and of shaking into shallow vessels containing kerosene, though the best known remedies, are not very satisfactory. Thus I am happy to report that I have raised a dipterous parasite from this insect. This fact is doubly interesting, not only from the destructiveness of the bug, and the difficulty in combating it, but it gives a page in the life history of the fly which was before unknown.

TRICHOPODA PENNIPES FABR.

This fly has long been known as a common insect about gardens, but its habits or life history have not been previously known so far as I can learn. Dr. S. W. Williston writes me that he has this insect from all over the United States, from South America and St. Domingo. He further adds

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that he is not aware that the habits of this genus have been before known. He states that the nearly allied Phasia has been found parasite on Pentatomia, which is also a bug, and not greatly removed from the squash bug. Towend Glover refers to this species in his manuscript notes, p. 57, and gives a rather poor colored drawing, plate IV., fig. 14 Say, edited by Le Conte, Vol. II., p. 364, describes the male. I have reared a male from the squash bug, Anasa tristis. Say gives an admirable description which I should copy were it not that it is too technical for my purpose. He describes the male, which is a little smaller than the female, and has the smoky, opaque color on the whole front of the wings. The insect (Fig. 4) is of a dark gray, almost black color, with golden yellow lines on the thorax and between the eyes. The abdomen is yellow and brown. The front between the eyes has a shining, velvety black line, which is slightly concave on the sides. At the lower outer angles of this line extend black, curved, horn-like lines, which reach down to an imaginary line which would connect the base of the antennæ with the lower margin of the eyes. The remainder of the front is creamy white with a satin-like luster. The eyes are large and purple; at the top they reach to the black line, upon which are three ocelli. The antennæ are brownish, bordered with black in the male, and black in the female, except the base of the third joint, which is brown. The first joint is short, the second longer and the third still longer and oval. A simple bristle as long as the antenna extends from the outside, near the base, of the third joint. The beak is black, the palpi yellowish. The front part of the thorax is golden yellow, with four black lines extending lengthwise. The two central ones are narrowest—close together, so that they nearly touch in front, where they reach the anterior border of the thorax. The lateral lines are broader, and are abbreviated in front, so they do not reach the anterior margin. The abdomen is golden at base, becoming brown towards the tip. Osten Sacken says that the abdomen of the female is entirely ferruginous. I find that there is often very little difference in the abdomens of the sexes, though usually the male only has the black tip. In some they are brown to the tip, while others are dark at the tip, irrespective of sex. The wings of the male are smoky opaque, except a narrow transparent posterior border. In the female there is a yellowish anterior area reaching from the base of the wing, which is about one-third the width of the wing and two-thirds the length. The poisers are honey yellow, while the base of all the legs, reaching beyond the middle of the thighs, is brownish yellow. The remainder of the legs are black, except the pulvilli, which are almost white. The posterior tibia are fringed with scale-like hairs, broader in the female, where there are about eighteen. There are only about twelve in the male. Thus the name pennipes. The whole insect is hairy. The hairs are either black or white.

Fig 4. Female of Trichopoda pennipes.

The male is 7 mm. (.3 in.) long, the female 10 mm. (.4 in.).

These flies are quite common. If all have the same habit as the ones I raised from the squash bug, we may well wish them even more abundant.

THE APPLE MAGGOT.—TRYPETA POMONELLA WALSH.

For the past few years this insect has been a more or less troublesome pest in various portions of Michigan. In 1884 I gave in the Report of the State

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Horticultural Society, page 200, an illustrated article on the insect. The remedy there recommended—feeding all apples on affected trees to swine, cattle or sheep, in early fall before the fruit fall to the ground, or at least before the insects leave the fruit—has been tried repeatedly in our State and with marked success.

This year I have received plums and late cherries from northern Michigan attacked by this same insect. So far as I know, this insect has not been previously reported as infesting either of these fruits.

EXPERIMENTS IN THE APIARY.

According to the plans adopted two years ago, the experiments in the Apiary are along four lines: Testing honey plants to determine whether any will pay for planting and growing exclusively for honey; breeding bees by crossing in hopes to secure a superior race; analyzing various kinds of honey to ascertain if any test for honey is possible and can be relied upon; and various points in manipulation, etc., which will come out with the year.

HONEY PLANTS.

The plants experimented with for the past season were Rocky Mountain bee plant (Cleome integrifolia), Chapman honey plant, Echinops sphero-cephalus, a mint, a species of Melissa, and Japanese buckwheat.

ROCKY MOUNTAIN BEE PLANT.

In growing this plant in small plats, as I have for years, I have previously learned that it does not germinate when sowed in the spring. Indeed the point has been raised against this plant that it is reluctant to start. From my experiments in small plats, I had not thought this an objection when the plants were sowed in the fall. Last autumn I sowed eight acres with this seed, obtained fresh from Colorado. A portion of the seed was sown early, the remainder quite late. All was dragged after sowing. The soil was very light sand, and had been cropped continuously for some years. Thus it was very weedy, and early in the spring I dragged the whole ground once over. None of the seed came well. That sowed latest came much the best. I am now of the opinion that the dragging both in the fall and spring were unfavorable to the welfare of the plants, as it was observed that about stumps, where balks or places not dragged occurred, the seed came much better. This seems the more reasonable, as in nature the seed is dropped early in the fall and is not at all covered. The plants in places came up well, but for the most part they were very scattering. The first blossoms opened June 13; June 24 the flowers were fully out. The bloom continued all through August. There were a few scattering blossoms even till frost came, the middle of September. Very likely there might have been more of these late blossoms had there been any rain. The bees worked on the flowers more or less all the season. At some times they fairly swarmed on the plants. There was a wood-lot between the apiary and the plants. Often the hum or roar of the bees was so loud in this wood-lot that persons walking through it were led to look for a bee tree.

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It will be observed that this plant is in bloom from July 15 to August 15, just the period whern there is almost no natural honey bloom—the period between basswood or linden and fall bloom. This season (1889) was very exceptionally dry, and it is difficult to say how that affected the plants. It is certainly true that our bees kept storing all through the usual dearth, and what I never knew before, swarmed enormously the last of July and first half of August. I could but wish that our whole eight acres had been a sea of bloom. Another feature commendatory to this plant is the long period that it is in bloom—from early June till the end of summer. The honey from the plant is very excellent, both as to flavor and color. The fact that this plant thrives and yields abundance of honey on the arid plains of Colorado may also give us hope that with a full stand we could secure a crop even in our dryest seasons. We only need to learn how to grow it with success to be able to decide these points. I shall try it thoroughly till I know whether it will pay for special planting. I am arranging to plant a large area again this year. This year I shall plant on clay and also on light sand. I know it does well on sand. Some transplanted plants on clay, the past season, did very poorly. We are now arranging to plant the seed on clay to see if it will do better. We now know that it will keep bees busy and give some honey. We have reason to hope, that if abundant enough, it will give a good paying harvest.

CHAPMAN HONEY PLANT.

Of this we have about an acre. It was planted in the spring of 1888. It does not bloom the first season. We planted it in drills and cultivated it the first summer. The second season it grew very vigorously and possessed the ground. I think we need never cultivate this after the first season. This plant commenced to bloom July 19, and a week later was in full bloom. The season lasted just about a month, as by August 20 the blossoms were nearly all wilted. The bees worked on this plant with great energy early in the day, but not so eagerly afterwards. We grew this on strong clay land. We could but wish that it was eight acres instead of one. Next year we shall plant a large acreage on sand. The vigorous habit of this plant, the time of bloom—just during the honey dearth of July and August—and the fact that when once started it will hold its own with no care, are greatly in its favor as a honey plant. I think there can be no doubt but that it furnishes much excellent honey, though I hope to demonstrate this with a larger area of the plants. The objections to this plant are its failure to bloom the first season after planting and the fact that the bees do not hang to it actively all the day through, as they do to linden and clover. It will be noticed that the period of bloom is much shorter than is that of the cleome.

THE MELISSA HONEY PLANT.

This beautiful, very sweet mint grows about a foot high, and bears a beautiful white blossom. It is very sweet, and well may be called bee-balm. It is an annual and grows readily on either clay or sand. It commences to bloom about two and one-half months after sowing, and fairly rings with bees till frost kills the flowers. By sowing or planting in early May it will

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be in bloom by the time the honey dearth comes on. Though not so long in bloom as is the Rocky Mountain bee plant, yet it is a long bloomer, and covers the period of need. It should be planted as early as possible in the season. The points in favor of Melissa are, first, the ease with which it is cultivated, its long period of bloom and the abundant supply of beautiful honey which it affords. The points against it are that it must be planted each season unless it will come up from its own scattered seed, and I fear unless cultivated it would soon be run out by more vigorous and hardy plants. I am pleased with the results the past season, and shall continue to investigate till we know whether it will pay to plant specially for bees. If by planting eight or ten acres of some plant we can secure a crop, whereas without this we would secure no harvest; or if, by special planting, we can in good seasons double our crop of honey, then such information will be most valuale. If we find, as may be true, that special planting is not profitable, then all should know this fact, that the many may not waste money in fruitless experimentation. At the very least, these experiments will prove what plants are best adopted for special planting in waste places. I understand that already in places in Iowa and Wisconsin, cleome has secured a foothold and is much prized by bee-keepers.

JAPAN BUCKWHEAT.

We have continued our experiments with this variety of buckwheat the present season. Last season we sowed it on clay soil, early and at the usual time of sowing, and secured a great crop, although the land was hard and unfertile and the season dry. This year I sowed it on light sand and on clay. I sowed it on June 15 and June 30. Although the season was very dry, both sowings on both soils gave a fair yield of very fine seed. It was in full bloom four weeks after sowing. That we might have data for comparison, three equal plats were sown side by side on soil that was about the same. The middle plat was Japanese, the outside plats silver hull and common buckwheat, respectively. These plats were sown late, and the ground was very dry and parched. The outside plats gave no seed at all—just nothing—while the Japanese, though not great, gave considerable fine seed.

I feel more than warranted in recommending all to sow this variety, if they wish to grow buckwheat. Now it can be purchased for from $0.75 to $1.00 per bushel for seed. It is far more productive than either the common or silver hull varieties. The seed is larger and finer, and it matures earlier. This last not only prevents destruction from early frost, but makes this variety more valuable for bee-keepers, as the earlier the bloom the better. Again, we find this variety proves as productive and reliable when sown the middle of June as when sown the first of July. If sown at this earlier date, the blossoms coming in full force, a month later, are just in time for the bees at the beginning of the honey dearth, from July 15 to August 15, between the harvests of basswood and fall flowers. Again, the plant will be out of bloom when the asters and golden rods, etc., commence to afford nectar, and so the inferior buckwheat honey will not be mixed with that from the fall flowers. Lastly it stands the drouth much better than the old varieties.

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EXPERIMENTS IN BREEDING BEES.

Our second point—breeding a special race by crossing the best known races, and carefully selecting and breeding from the best of these hybrids—will only prove valuable after several years, if at all. Already we are pleased, however. We have crossed the Syrian and the Carniolans. Our bees have now, in some degree, the activity and prolificness of the Syrians and the amiability of the Carniolans. We wish still further to heighten their good qualities and to render fixed those already secured. We hope to continue this experiment for several years.

TESTING HONEY.

We are still making collections of different kinds of honey, or of honey from different known sources. Owing to the varied sources from which honey is derived, it seems very probable that its composition is very varied. It is also well known that honey is digested nectar. I have reason to believe that in case honey is produced very rapidly, as when bees are collecting nectar from linden, the digestion is somewhat imperfect, and so the honey will contain more cane sugar and less reducible sugar. On the other hand, when the honey is stored more slowly, as from the mints and clover, the digestion is more perfect. Thus we are securing honey from all sources; that collected rapidly and that more slowly stored. We shall also feed cane sugar as rapidly as the bees can store it, and also slowly, to see if we can notice any difference in the degree of transformation from cane to reducible sugar. It is hoped that we shall have sufficient material to investigate this matter thoroughly the coming season, when I believe we shall show that neither the chemical test—reduction of the copper salts—or the polariscopic test—deflection of the polarized ray—are reliable in testing honey. When we find that we need a better test, then we may expect that it will be forthcoming.

EXPERIMENTS WITH CHLOROFORM.

It is very desirable that the bee-keeper should be able to introduce easily, quickly and safely, *any* queen at *any* time, whether virgin or mated. We experimented quite extensively in this direction the past season. We often took virgin queens, three and four days from their so-called hatching —their emergence from the queen cells. We first removed the old queen; then with a common bee smoker, in the fire tube of which were three sponges, the lower and upper tight fitting, and the middle wet with ether or chloroform, we forced the quieting fumes into the hive. This was done till the bees would fall freely to the bottom of the hive. The new queen, old or young, virgin or mated, was then allowed to enter. In no case do we know that the queen was destroyed. In nearly every case the queen was found upon subsequent examination, safe and busy in the hive. In a few cases where virgin queens were introduced, they had disappeared two days later. It is probable that these were lost in mating. We lost, a year ago, a much larger number that were not removed at all from the nuclei. In our new apiary we have no trees; only hives on a smoothly kept lawn. In our old apiary, with an evergreen at each hive, we rarely lost a queen in mating.

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Now it is not very uncommon. From our experiments this season, we are led to the belief that by use of chloroform, queens, old or young, virgin or mated, may be almost if not always safely introduced. We could see no harm to the bees from the use of the anæsthetic.

We also tried in a small way this same method to cure the swarming impulse. We destroyed all queens' cells and saw that the bees had plenty of room to work, while they were under the influence of the chloroform. In the few cases tried there was no further preparation for swarming, or attempt to swarm. We shall try both these plans another year very thoroughly, that we may advise positively as to the excellence of the methods. We are prepared now to recommend them tentatively.

REMOVING QUEENS DURING THE HARVEST.

We tried the following experiments in hopes to find whether it were best to remove queens during the season of gathering, that in the lapse of breeding, more honey might be secured. The season was a *very poor* one. We tried to select colonies of about the same strength and vigor. Of two colonies worked for extracted honey, neither of which swarmed, the one with queen gave us during the clover and basswood season season fifty-one (51) lbs.; the one without queen only twenty-six (26) lbs. This case seemed exceptional. We can offer no explanation or suggestion as to the cause. Six colonies worked for comb honey that made no attempt to swarm —the sections were on the hive at the very dawn of the harvest—gave respectively 31 lbs., 28 lbs., 21 lbs., 25 lbs., 23 lbs., and 24 lbs. This gives a total of 152 lbs., or an average per colony of 25⅓ lbs. Five colonies run for comb honey, whose queens were removed, made respectively 55 lbs., 35 lbs.—these two colonies were in restricted hives, in the lower section of a Heddon hive—24 lbs., 32 lbs., and 32 lbs. Here the total was 178 lbs; the average per colony 35⅗ lbs. It would seem that restricting the brood chamber in this case was an aid. We should have weighed the hives before and after the experiment to see how much honey was stored in the body of the hive. This, however, we neglected to do. The results are only suggestive. Another year with a better harvest may give more decided results. The actual practice, in this case, would seem to support theory that in a colony with no queen, and so with no maturing brood, but contented, as they were not without means to rear a queen, would produce more honey than a colony with a queen, and where rapid brood-rearing was continually in progress.

FEEDING BACK.

At the close of the basswood season, a colony with partially filled sections was given a restricted brood-chamber so that it could not store except in the sections. The queen was removed, and it was fed thirty-seven pounds of good thick extracted honey. The sections increased thirty pounds, so we conclude that thirty pounds were stored. Another colony in one section Heddon hive were given unfinished sections weighing eighty pounds. They were fed twenty pounds of extracted honey, and the sections were filled and sealed and weighed one hundred pounds. It would seem that this colony must have gathered some honey, at the time, from the outside, though a colony on the scales seemed hardly more than to hold its own and the other

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colonies in the apiary did not seem to gain much, though all did gather enough to hold their weights. I believe in this matter of feeding back at the close of the season, we have a promising field for experimentation. We shall try to do much in that line another year.

CUCKOO BEES.

Cuckoo bees are such as enter the nests of other bees for the purpose of laying their eggs and having their brood fed and cared for by others. This name was doubtless applied to these bees from the similar habit of the English cuckoo. This bird, like the cow-bird in our own country, lays its eggs in the nests of other birds. Thus incubation, and the subsequent feeding and guarding, is performed by other than the parent bird. It has long been known that species of the genus Apathus—wild solitary bees—are wont to steal into the nests of bumble bees, where they lay their eggs. Thus the bumble bees feed and care for the larvæ of these wild solitary bees, which are thus relieved from all trouble and care. In my Bee Keepers' Guide, page 29, I say: "A few of the Apidæ—thieves by nature—cuckoo-like, steal unbidden into the nests of other bees and lay their eggs. As their young are fed and fostered by another, such bees gather no pollen, and so, like drone bees, need no organs for collecting pollen. These parasites illustrate mimicry, already described, as they look so like the foster-mothers of their own young that unscientific eyes would fail to distinguish them. Probably the bees thus imposed upon are no sharper, or they would refuse ingress to these merciless vagrants." I think I might have added: There is doubtless protective scent, for often the color mimicry is not so close; and more, these same bees would repel an intruder of their own species of another colony without mercy. In the Bee Keepers' Guide, page 34, I say further: "Other bees—the numerous species of Nomada and Apathus, are the black sheep in the bee family. These tramps steal in upon the unwary, and, though all unbidden, lay their eggs—in this way appropriating food and lodgings for their own yet unborn. Thus these insect vagabonds impose upon the unsuspecting foster-mothers in these violated homes, and these same foster-mothers show by their tender care of these merciless intruders that they are miserably fooled, for they carefully guard and feed infant bees which, with age, will in turn practice this same nefarious trickery. The Apathus species are parasite on the Bombus." So far as I know these bees have never been known to invade the sanctity of the hive before this year. This year they have been known in several cases, more especially in Indiana, to breed in the hive of the honey bee. In some cases hundreds have been found in a colony of bees. This is a matter of much scientific and practical interest. These bees are solitary. That is, they do not live in colonies as do ants, bumble bees and honey bees. The female mates, then hastens, not always to the nests of bumble bees, as we now know, but also to the populous hive of the honey bee. It is strange that they are permitted to enter; but they are, with no seeming opposition. Once in the eggs are laid in the cells, and the Apathus larvæ cared for as though they were veritable honey bees. I have received several mutilated specimens of these bees. I am sure that they are Apathus; but I am uncertain regarding the species. I shall be able to determine this point another season. Just how much harm these bees may do I cannot tell. If they

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only reach a few score in each colony of bees, we need not be anxious regarding them; if they reach thousands then they would become a serious pest. It will be necessary to learn their entire life history before we can measure their possible damage. We can say more when we know how they pass the winter.

In 1888, early in the season, my assistant was called to the experimental station of another State. This year the misfortune was repeated. Of course it is not possible to do the most satisfactory work unless we can keep our assistants. We must not only keep the men aiding us for the entire year, but we must be able to keep the same man a succession of years. In my opinion this is a matter worthy of serious consideration. I wish in this connection to express my hearty appreciation of the good work of my assistants the past season. Messrs. A. B. Cordley, C. B. Cook, F. H. Hillman and F. J. Niswander have all aided me, and each has done excellent, conscientious work. Each has seemed deeply interested in the work.

A. J. COOK.

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REPORT OF THE BOTANIST.

To Oscar Clute, M. S., Director of the Experiment Station:

DEAR SIR—I herewith submit my second annual report for the year closing June 30, 1889:

I need not tell you nor any of our readers that this date is a most unfortunate one for reporting the progress of any out-door experiments, as it necessitates the placing of two halves of a report of two different growing seasons.

At the outset it becomes necessary for the reader to familiarize himself with the report for 1888. Three visits have been made during the year to each of the northern stations. The work is done by hired help and is not always done well nor strictly in accordance with the directions given.

EXPERIMENTS AT GRAYLING.

The plats of grasses and other forage plants are on old land rented of Mr. Brink, and the reader may remember are each one rod square. The soil is typical jack-pine plains and has been previously cropped for several years with little or no manure of any kind. As everyone had reason to expect, a large number of the grass plats amounted to nothing. The seeds of some failed to germinate; others germinated, but the plants remained small and soon perished for one or more reasons; others have established themselves and still retain life; some have made a small growth; others have done pretty well.

In addition to what were sown when my last report was made, are the following, sown September 21. The seeds sown this spring came up better than those sown a year ago:

Achillea Millefolium L.
(Yarrow Milfoil.)
Agropyrum caninum R. & S.
(A Wild Grass.)
Agropyrum dasystachium Vasey.
(A Wild Grass.)
Agropyrum divergens Nees.
(A Wild Grass.)
Agropyrum glaucum R. & S.
(A Wild Grass.)
Agropyrum tenerum Vasey.
(A Wild Grass.)
Agropyrum unilaterale Vasey & Scribner.
(A Wild Grass.)
Agrostis alba L.
(Red Top.)
Agrostis scabra Willd.
(Hair Grass.)
Agrostis stolonifera L.
(Creeping Red Top.)
Alopecurus pratensis L.
(Meadow Foxtail.)

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Ammophila longifolia Benth.
(A Wild Grass.)
Andropogon provincialis Lam.
(Turkey Foot Grass.)
Andropogon scoparius Michx.
(A Wild Grass.)
Arrhenatherum avenaceum Beauv.
(Tall Oat Grass.)
Asprella hystrix Willd.
(Bottle Grass. A Wild Grass.)
Avena flavescens L.
(Yellow Oat Grass.)
Avena nuda L.
(Naked Oats.)
Beckmannia erucæformis Host. var. *uniflorus*.
(Scrib.)
Bouteloua hirsuta Lag.
(A Wild Grass.)
Bouteloua racemosa Lag.
(A Wild Grass.)
Brachyelytrum cristatum Beauv.
(A Wild Grass.)
Briza maxima L.
(Introduced.)
Bromus ciliatus L.
(Introduced.)
Bromus imernis.
(Introduced.)
Bromus secalinus L.
(Chess. Introduced.)
Capparis herbacea.
(From Russia.)
Cenchrus catharticus.
(From Russia.)
Cenchrus montanus.
(From Russia.)
Chloris barbata.
(Introduced.)
Chrysopogon nutans Benth.
(A Wild Grass.)
Cinna arundinacea L.
(A Wild Grass.)
Cynosurus cristatus.
(Crested Dogstail Grass. Introduced.)
Dactylis glomerata L.
(Orchard Grass.)
Deschampsia. ?
Deyeuxia Canadensis Beauv.
(Blue Joint.)
Eatonia Pennsylvanica Gray.
(A Wild Grass.)
Eleusine flagelliflora.
(From Russia.)
Eleusine scindica.
(From Russia.)
Elionurus hirsutus.
(From Russia.)
Elymus arenarius.
(From Russia.)
Elymus Canadensis L.
(A Wild Grass.)
Elymus Europeus.
(A European Grass.)
Elymus striatus Willd.
(A Wild Grass.)
Elymus Virginicus L.
(A Wild Grass.)
Eragrostis major Host.
(Introduced.)
Eragrostis viscosa.
(From Russia.)
Festuca duriuscula L.
(Hard Fescue.)
Festuca elatior L.
(Tall Fescue.)
Festuca nutans Willd.
(A Native Grass.)
Festuca ovina L.
(Sheep's Fescue.)
Festuca ovina var.
Festuca pratensis L.
(Meadow Fescue.)
Festuca rubra L.
(Red Fescue.)
Festuca tenella Willd.
(A Native Grass.)
Glyceria arundinacea Kunth.
(A Native Grass.)
Glyceria Canadensis Trin.
(A Native Grass.)
Glyceria fluitans R. Br.
(A Native Grass.)
Glyceria nervata Trin.
(A Native Grass.)
Holcus lanatus L.
(Velvet Grass.)
Hordeum jubatum L.
(Wild Barley.)
Iselema laxum.
(From Russia.)

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Kœleria cristata Pers.
(A Native Grass.)
Leersia oryzoides Swz.
(A Native Grass.)
Lespedeza striata.
Linum usitatissimum L. var. *macrospermum.*
(Large Seeded Flax.)
Lolium Italicum L.
(Italian Rye Grass.)
Lolium temulentum L.
(Darnel.)
Medicago sativa L.
(Lucerne. Alfalfa.)
Melilotus alba Lam.
(White Melilotus.)
Molinia cœrulea Mœnch.
(Introduced.)
Muhlenbergia Mexicana Trin.
(A Native Grass.)
Onobrychis sativa Lam.
(Sain-Foin.)
Oryzopsis melanocarpa Muhl.
(A Native Grass.)
Panicum capillare L.
(Witch Grass.)
Panicum Crus-galli L.
(Barnyard Grass.)
Panicum glabrum Gand.
(Introduced.)
Panicum miliaceum L.
(Millet.)
Panicum sanguinale L.
(Finger Grass.)
Panicum virgatum L.
(A Native Grass.)
Pennisetum cenchroides Rich.
(From Russia.)
Phalaris arundinacea L. var. *picta.*
(Reed Canary Grass.)
Phleum pratense L.
(Timothy.)
Plantago lanceolata L.
(Rib Grass.)
Poa compressa L.
(Flat-Stemmed Poa.)
Poa Nevadensis Vasey.
(From the West.)
Poa serotina Ehrh.
(Fowl Meadow Grass.)
Poa trivialis L.
(From Europe.)
Raphanus sativus L.
(From Russia.)
Setaria glauca Beauv.
(Pigeon Grass.)
Setaria viridis Beauv.
(Pigeon Grass.)
Soja hispida var. *chlorosperma.*
(From Russia.)
Spartina cynosuroides Willd.
(A Native Grass.)
Sporobolus cryptandrus Gray.
(A Native Grass.)
Sporobolus heterolepis Gray.
(A Native Grass.)
Trifolium hybridum L.
(Alsike Clover.)
Trifolium medium L.
(Mammoth Clover.)
Trifolium pratense L.
(Red Clover.)
Trifolium repens L.
(White Clover.)

The Niagara grape vine, presented by E. M. Roffee, Clyde, N. Y., last year sent out two or three slender shoots, the longest of which was two feet long. They all winter-killed, or at least died back to the ground. This spring the first shoots were killed by the late frosts, and on June 30 there were several feeble shoots two or three inches long still growing below the surface of the soil. I never expect to see luscious Niagaras grown at Grayling in the open air.

The Russian trees, planted in the spring of 1888, still remain where first set. There were thirty-five species in all, some in the form of cuttings, only two to ten of each kind. The number of each was too small to warrant any conclusions at this time as to their value. Some have died, a few have done very well, and on the whole they seem to promise more for this soil and climate than most of our natives.

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Of the forty-one species of native and European trees planted in the spring of 1888, a good many died, either during the summer or the succeeding winter. There may be a good deal in the unusual nature of the past year to cause the death of young trees. Some varieties were killed; further trials will be made, and when there is anything definite to report, so that anyone can be warranted in drawing conclusions, the results will be given. Cuttings, six or eight inches long, of one year's growth, nearly all died. If cuttings are set in the open field, they should be much longer and rather larger.

The trees planted on land simply harrowed, or not even harrowed, are not promising at present.

This spring about an acre of ground was plowed for the first time and set to small trees of white pine, Norway pine, Norway spruce, box-elder and locust. Some seeds of pitch pine, *Pinus rigida* Mill., were sown in two or three places and many of them have come up. Chestnuts were also planted.

WALTON.

In this connection I can do no better than take notes from an article prepared for the *Grand Traverse Herald*, and published on April 11, 1889:

"The spring last year was very cold and backward, and the summer unusually dry. Everything had to be got ready, the land selected, prepared, and seed purchased and sown. We had nothing certain about money to use in this way till late in February, 1888. The seeds were put in on May 11.

"The land was rented of Abram F. Philips, and is enclosed by a board fence. It joins the Traverse City branch on the north side of the railroad track, about one mile from the village of Walton, and may be seen as trains pass the spot.

"The Experiment Station year closes on June 30 of each year, hence at that early day my first report, not long since printed in the report of the Board of Agriculture, could not contain much information on the experiments.

"The land is divided into plats of about one-fourth of an acre each. It formerly contained a few small white oaks, scattering Norway pines, a few inferior white pines and numerous trees of jack pine. It had never been plowed until last spring. The roots of sweet ferns, brakes, huckleberries, bearberries, morning-glories, willows and numerous other species of small, woody and herbaceous plants are tough and numerous, and some of them very large and slow to decay. The land was plowed, harrowed, the seed sown broadcast, and then rolled. No fertilizers of any sort were used. There was one plat of Hungarian grass, one of German millet, one each of rye, meadow fescue, alfalfa or Lucerne, alsike clover, June grass, Timothy, Italian rye grass, spurry, perennial rye grass, meadow foxtail, field peas, mammoth clover, red clover, sweet clover, orchard grass, tall oat grass, one of a mixture of mammoth clover and orchard grass, one of a mixture of tall oat grass and orchard grass, and one with eight sorts sown on the same plat, viz.: Fowl meadow grass, orchard grass, Timothy, tall oat grass, perennial rye grass, meadow fox-tail, red clover, mammoth clover.

"Adjoining these plats was another, where the land was picked up and simply scratched over with a spring-tooth harrow. On this seven sorts were sown. Adjoining that was another plat where no preparations had been made—no cultivation. On this seven sorts were sown. The place was

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visited three times after the seed was sown, the last of which was on October 18. At that time there were no very flattering notes to be made. Some of them were as follows: Rye, thin, two and one-half feet high, better than that at Oscoda; millet and Hungarian very thick, some of it eighteen inches high; alfalfa spindling, hardly thick enough; the roots are as large as pipe-stems and the plant is getting down to business so that it is difficult to pull it up. Where eight sorts were sown, the ground is evenly and thickly covered and appears the most promising of any. June grass is hardly to be seen anywhere, and then very small. Alsike clover is too thin, but makes some show; a few plants have seeded. Meadow fescue has some good patches. Spurry is about a foot high and very thick. Italian rye grass looks well, all things considered; Timothy thin and poor; peas a small, thin crop; meadow foxtail too thin, will need seeding over; perennial rye grass much ahead of Timothy; sweet clover very pale and thin with long, large roots; red cover a thin catch, a very little of it seeding; mammoth clover thick and better; orchard grass makes a very good showing, beating Timothy by all odds; tall oat grass thin and spotted, some three feet high.

"There is quite a 'sprinkling' of wild stuff still growing among the grasses. Huckleberries, sweet ferns, brakes, bearberries, asters, golden rod, dewberries, and many other plants turned about after the land was plowed and soon came to light right end up, as though nothing had happened. In fact, they seemed to enjoy the little cultivation the land had received, as a good share had been killed, leaving a better chance for the survivors.

"Hon. C. W. Garfield, a member of the State Board of Agriculture, and formerly secretary of the State Horticultural Society, was with me on the last visit, and enjoyed the examination of the specimens very much.

"I have often been asked in person and by letter what I thought was the outlook for successful farming on these lands. I expect to promise nothing, but give results as fast as they are obtained. I am quite inclined to agree with the general verdict, that the lands are entitled to rank as poor, that most likely it will be natural for people to buy the best lands just when they are about to go into farming, at least while good lands are cheap and abundant, as they still are in northern Michigan.

"We left the station on the evening of October 18, after hard frosts had killed all tender vegetation. Growth had ceased, and plants of all sorts had got ready for the long sleep of a six months' winter.

"On April 9, 1889, as the snow banks had crept behind the fences or retreated to the dense forests, the ice melted away, the robins returned for nesting, the frogs revived, the pussy willows appeared, the elders began to lengthen their limbered catkins and shed their pollen, I was anxious again to see how things looked at the experiment stations.

"The winter had been unusually open. Of course we all know that rye, millet, Hungarian grass and peas which seeded last year would die in autumn. Spurry is a chickweed-like plant, and is also an annual. It has been successfully used in some parts of Europe as a 'starter' on poor, sandy land. It makes good food for live stock. Last autumn the crop of seed was abundant and much of it had sprouted and rooted. These young plants are all dead. Whether there are yet enough seeds still living for another crop this year I cannot now tell. We will wait and see.

"Italian rye grass in the old country is called an annual. It has always proved such during many years of experimenting at the Agricultural Col-

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lege. To my surprise and gratification none of it died last winter in Traverse county. Perhaps the growth was so small it was not fit to die, and nature dealt gently with it. The other grasses and clovers all lived. I could not find a single plant that had suffered. The sweet clover is not thought to be of any use for pasture or hay, but it has been mentioned as a promising plant for plowing under to enrich the land.

"The side buds are already pushing just at the surface of the ground. Every one is watching the alfalfa with much interest. It is now beginning to grow, but it is yet too soon to predict success for it on the sands of Michigan. Lucerne is the French name for the same plant. The young plants are rather slow to get well established; it is not suitable for pasture anywhere, but is a favorite in some regions for mowing. For good hay it should be cut before it blossoms or very soon after, and cured as we cure red clover.

"On studying the ground over again this spring I think we are learning something. I have patched some plats by another seeding. I am trying a little rotted barn-yard manure on a small part of many of the plants, also gypsum, or plaster, on the clover and on spurry, but not on the grasses. I shall use a very little homestead superphosphate, sown two or three times on a small part of each plat. In this way, with many questions from all sources, and open eyes, and new grasses and clover from other sources, I still hope to be able in due time to arrive at conclusions which shall be interesting and valuable to all citizens of Michigan, and whichever way the question is decided in the end, the experiments will be worth a thousandfold what they will cost."

Among other things, on June 28 the following notes were made: Season very early and dry till near the end of May; June usually wet and cool. The piece only harrowed (not plowed) and sown with seven sorts has made some progress, and begins to look as though it would finally make some headway. The sorts sowed on land neither harrowed nor plowed have made no start.

Manure and superphosphate, the latter sown once, improve orchard grass and mammoth clover, in same plat together, to about the same extent.

I cannot see that superphosphate improves orchard grass and tall oat grass sown together; manure has helped both species.

Superphosphate on orchard grass alone doesn't seem to have helped it, while barn-yard manure has produced a marked effect.

The tall oat grass is thin, not as good as I had expected it would be.

Sweet clover is also very scattering and spindling; nearly all had been eaten to the ground by cut-worms, but was sprouting just below the surface of the ground.

Red clover does not seem so promising as mammoth clover. On a patch of mammoth clover the superphosphate seems to have done more good than the top dressing of barn-yard manure, but it must be remembered that the piece is small, that there may be some difference in the land, that I am unable to know for certain just how much manure was used or how much superphosphate. The notes in regard to this rough experiment are given as indicating the nature of further and more extended experiments more carefully made.

Much of the spurry sprouted last fall and died. Some seed remained over winter, and patches of the plants are seen here and there.

Timothy is very thin, some of it two feet high.

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June grass sown last year is very thin and small, and that sown this spring is very slender, some of it an inch high.

Alsike clover pleases all who see it; bees are working freely on the numerous blossoms. The plants are rather thin on the ground and each plant spreads, but I believe mammoth clover in August will cut the most in weight. Manure helps the alsike clover, but superphosphate seems to have helped it still more.

The alfalfa is thin, slender, ten inches high, and probably is pining for more heat.

Meadow fescue is two and one-half feet high and in flower. Plants are thin, but make quite a display; on the whole better than the Timothy.

Strawberries are spreading quite freely and some are in fruit, or have been this season. They are common on the plains.

Mr. R. Knaggs, in the village, has raised good strawberries year after year on the same ground without any manure.

BALDWIN.

The plats at this place nearly repeat those at Walton previously noticed. I give a few notes taken on June 29, of this year:

Where nine species were sown on new land after it had merely been harrowed once, there is rarely a plant to be seen of the species sown. Mammoth clover covers two-thirds of the ground where it was sown last year after plowing, and is twenty inches high. Early red clover is thinner and shorter; orchard grass patchy and very short; alsike clover spreading, not so good as at Walton; Timothy one-half to two feet high; tall oat grass three to five feet high, but found in scattering bunches. But little was sown. The ground in this plat may be rather better than that of some others. No spurry was seen. Where nine sorts were sown together on cultivated ground the grasses are thickest and best of all the plats. There is a very good crop, the clovers predominating.

Through some mismanagement no superphosphate was sown at Baldwin, and but very little manure could be obtained at the stables in the village. A little plaster was sown on a part of each of the plats and seems to have done a little good.

HARRISON.

The old land mentioned in my last report had been cropped six or more times in succession without the use of any fertilizers or without seeding to grass or clover. It was very thin. The land leased was part of a large field of an abandoned farm. The fence was very poor. The owner declined to keep it in repair for another year. This part of the work at Harrison has been abandoned. The experiments of a single season have helped to indicate that there is no use in cropping or seeding such land to anything without the use of fertilizers of some kind.

The ten acres of new land given us by Messrs. Wilson will next be noticed. Half of it was plowed for the first time last fall. The south two acres were well "grubbed" before plowing; the three acres north of the south two acres were not "grubbed" before plowing. The five acres plowed last fall were rolled and harrowed well this spring and seeded as follows: A piece

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of alfalfa, a piece of tall oat grass, one of orchard grass, one of perennial rye grass, one of alsike clover, one of mammoth clover, one of red clover, and one containing a mixture of red clover, mammoth clover, alsike clover, alfalfa, perennial rye grass, tall oat grass, orchard grass and Timothy. A piece in each case, about twenty feet square, had a liberal dressing after seeding of fairly well rotted barn-yard manure.

The spring, soon after seeding, was wet and the seeds have all started nicely; some of the tall oat grass was eighteen inches high when the place was examined. The man in charge of the work moved away, and hence did not sow the superphosphate according to the plan.

OSCODA OR AU SABLE.

In October of last year the notes regarding the grass plats may well be summarized by saying "plants thin, scattering and small." In April about twenty feet square on each plat was well top-dressed with fine manure, and near a stake put in the center of all plats of clovers, spurry, alfalfa and sweet clover, there was sown about two quarts of superphosphate to a rod. On July 5, 1889, I took notes and now report the following:

The barn-yard manure has helped everything on which it was applied.

Spurry, self-sown last fall, is thick enough on half of the ground; eight inches high; superphosphate seems to help it.

Red clover sown in the spring of 1888; a few patches are fair; the rest of the ground is well covered with sorrel.

Meadow fescue sown in the spring of 1888 is very thin, but quite evenly scattered; two and a half feet high.

Sweet clover sown in the spring of 1888; there is a little at the south end; it is of no account.

Timothy sown in the spring of 1888 is very thin, hardly as good as meadow fescue.

Red clover and mammoth clover sown this spring is coming up well.

Alfafa is very thin and a foot high; the manure and the superphosphate appear to have helped it about the same degree.

Alsike clover sown in the spring of 1888 is now patchy, small, spreading and in flower.

Meadow foxtail sown in the spring of 1888; there is but a very little and that is about two and a half feet high.

Mammoth clover is as promising as anything.

June grass sown last spring and again this spring makes a very poor showing.

Italian rye grass and perennial rye grass sown in spring of 1888 are much alike; thin, a foot high.

Clover seeded this spring is helped by superphosphate as well as by manure.

Trees were planted on about an acre of new land this spring.

The land was plowed for the first time and then harrowed. The small groves and scattering trees of jack pine were left standing. The trees were in rows east and west, four feet apart. They have been hoed and will be hoed again and again. They were too small, being about six inches high. The species consisted of white pine, Norway pine, Norway spruce, box elder, locust and some seeds of pitch pine, *pinus rigida.*

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EXPERIMENTS AT THE COLLEGE.

To fully understand what follows, the reader must first read the last report as found on pages 141 and 178 of Michigan Board of Agriculture for 1888. The sizes of the plats are mostly sixteen feet square. In case the plat is a prominent one, the plat is about thirty feet square or even larger.

Full notes are made from time to time in regard to the success or failure of each species.

At present we have no conclusive experiments or observations to report on this subject.

It would be difficult to imagine a more unfavorable fall and spring than the last has been for the purpose of establishing anything like a complete set of grass plats. Many of the grasses are delicate and difficult to start at best, and even those in common cultivation have, in many cases, proved unequal to the task of forming a perfect seeding.

About seventy-five sorts were sowed in the fall, beginning about the time of wheat-sowing. Some of the earliest sowed sprouted last fall, but more did not show above ground till spring, and at this writing (June 20) not a few are only just pricking through after nearly nine months in the ground. Time and season certainly are factors in the germination of many seeds, as well as are heat and moisture. Still others have not yet appeared above ground, and whether this is from poor seed or some other cause remains to be seen.

One plat seeded to chess was a great success, and, though thinly seeded, it was the first to appear, has been the greenest spot in the field, and has been lodged from its heavy growth since June 1. Many passers-by refuse to believe it is from chess seeds, and in the spring offers were freely made to bet money that the plat was oats. Such is still the lingering prejudice regarding the origin of chess, happily fast disappearing, however, before better farming and more exact knowledge.

About one hundred plats were seeded in the spring and are looking well, but their ultimate success will depend largely on the succeeding weather. One plat of about a half acre was seeded to a mixture of one hundred sorts of grasses and clovers, with the object of watching the battle for standing-room and nutriment. The seeding is somewhat thin and in a variety of soils. Certain features of a plant can be tested in no better way than by placing it where competition is sharp and where the struggle for existence is severe.

Besides most of the common American native and cultivated grasses and clovers, there are started some twenty sorts of Russian forage plants. An assortment of seeds from India arrived too late for spring planting, but will be planted this fall. We have not yet succeeded in securing seeds from eastern Asia or southern South America, but the plan is not abandoned, and it is more than likely that among the many sorts native there, some might be found of great value here.

Four plats of the original sod, at least twenty years old, have been preserved as permanent meadow or pasture to be compared with newer seeding.

Appended is an alphabetical list of the varieties already planted, excluding a few that have not yet appeared above ground and are not likely to come. Of many sorts there are duplicate plats of seeds from different localities.

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Agropyrum caninum R. & S.
" *dasystachyum* Vasey.
" *divergens* Nees.
" *glaucum* R. & S.
" *repens* Beauv.
" *tenerum* Vasey.
" *unilaterale* V. & S.
Agrostis Abyssinica.
" *asperifolia* Trin.
" *canina* Linn.
" *dispar.*
" *scabra* Willd.
" *vulgaris* With.
" *vulgaris var. alba* (red top)
(*A. alba* Linn.)
Agrostis vulgaris var. stolonifera.
(*A. Stolonifera* Linn.)
Alopecurus agrestis L.
" *geniculatus* Linn.
" *geniculatus var. aristulatus* Munro.
Alopecurus pratensis Linn.
Amphicarpum Purshii Kth.
Andropogon provincialis Lam.
" *scoparius* Michx.
Anthoxanthum odoratum Linn.
Apera spica-venti Beauv.
Arrhenatherum avenaceum Beauv.
(Tall Oat Grass; Evergreen Grass.)
Asprella hystrix Willd.
(Bottle Grass.)
Avena hirsuta.
" *nuda.*
Beckmannia erucæformis Host.
Bouteloua hirsuta Lag.
" *oligostachya* Torr.
" *racemosa* Lag.
Brachyelytrum aristatum Beauv.
Briza maxima.
Bromus breviaristatus Thurb.
" *brizæformis.*
" *ciliatus* L.
" *Kalmii* Gray.
" *mollis* L.
" *unioloides* Willd.
" *secalinus* L.
(Cheat, Chess.)
Cenchrus catharticus.
(From Russia.)
Cenchrus montanus.
(From Russia.)
Cenchrus tribuloides L.
Chloris berbata.
(From Russia.)
Chrysopogon nutans Benth.
Cinna arundinacea L.
Coix lachryma L.
(Job's Tears.)
Cynodon dactylon Pers.
(Bermuda Grass.)
Cynosurus cristatus L.
(Crested Dog's Tail Grass.)
Dactylis glomerata L.
(Orchard Grass.)
Danthonia spicata Beauv.
Deschampsia cæspitosa Beauv.
" ?
Deyeuxia Canadensis Beauv.
(Blue Joint.)
Eatonia Pennsylvanica Gr.
" *obtusata* Gr.
Eleusine flagellifera.
" *Indica* Gært.
Elymus arenarius L.
" *Canadensis* Linn.
(Wild Rye; Lyme Grass.)
Elymus condensatus Presl.
(Giant Rye Grass.)
Elymus Europeus.
" *striatus* Willd.
" *triticoides* Nutt.
" *Virginicus* L.
(Wild Rye.)
Elymus Virginicus var. glauca.
Eragrostis major Host.
" *pilosa* L.
" *pectinacea* Gray.
" *viscosa.*
(From Russia.)
Festuca duriuscula L.
" *elatior* L.
(Tall Fescue.)
Festuca pratensis L.
(Meadow Fescue.)
Festuca nutans Willd.
" *ovina* L.
(Sheep's Fescue.)
Festuca ovina var. ?
" *rubra* L.
" *scrabrella* Torr.
" *tenella* Willd.
Glyceria arundinacea Kth.

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Glyceria Canadensis Trin.
(Rattlesnake Grass.)
Glyceria fluitans R. Br.
" *nervata* Trin.
Graphephorum melicoides Beauv.
Holcus lanatus L.
(Velvet Grass.)
Holcus mollis L.
Hordeum jubatum L.
(Squirrel Tail Grass.)
Kœleria cristata Pers.
Leersia oryzoides Swz.
" *Virginica* Willd.
(Cut Grass.)
Lolium perenne L.
(Rye Grass.)
Lolium perenne var. Italicum.
(Italian Rye Grass.)
Lolium temulentum L.
Milium effusum L.
Molinia cærulea Mœnch.
Muhlenbergia diffusa Schreb.
(Nimble Will.)
Muhlenbergia glomerata Trin.
" *Mexicana* Trin.
" *sylvatica* T. & G.
Oryzopsis asperfolia Michx.
" *melanocarpa* Muhl.
Panicum capillare L.
" *olandestinum* L.
" *crus-galli* L.
(Barnyard Grass.)
Panicum crus-galli L. *var. hispidum.*
" *depauperatum* Muhl.
" *dichotomum* L.
" *glabrum* Gand.
" *latifolium* Muhl.
" *milliaceum* L.
(From Russia.)
Panicum sanguinale L.
(Crab Grass.)
Panicum virgatum L.
Pennisetum longistylum.
Phalaris arundinacea L.
" " *var. picta.*
(Cultivated.)
Phalaris arundinacea.
(Cultivated and reverted.)
Phalaris Canariensis L.
Phleum pratense L.
(Timothy.)
Poa alpina L.
" *annua* L.
" *arachnifera* Torr.
" *compressa* L.
(Blue Grass.)
Poa debilis Torr.
" *nemoralis* L.
" *Nevadensis* Vasey.
" *pratensis* L.
(June Grass; Ken. Blue Grass.)
Poa serotina Ehrb.
(Fowl Meadow Grass.)
Poa sylvestris Gray.
" *trivialis* L.
Setaria glauca Beauv.
(Pigeon Grass.)
Setaria viridis Beauv.
(Green Pigeon Grass.)
Spartina cynosuroides Willd.
" *juncea* Willd.
Sporobolus cryptandrus Gray.
" *S. pallidus.*
(From Russia.)
Sporobolus heterolepis Gray.
Stipa spartea, Trin.
Tricuspis seslerioides Torr.
Triticum vulgare L.
(Common Wheat.)
Zizania aquatica L.
(Wild Rice; Indian Rice.)

OTHER THAN GRASSES.

Achillea millefolium L.
(Yarrow.)
Capparis herbacea.
(From Russia.)
Elionurus hirsutus.
(From Russia.)
Iseilema laxum.
(From Russia.)
Linum usitatissimum L.
(Flax.)
Medicago sativa L.
(Alfalfa; Lucerne.)
Melilotus alba Lam.
(Sweet Clover.)
Onobrychis sativa Lam.
(Sainfoin.)

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Lespedeza striata.
(Japan Clover.)
Plantago lanceolata L.
Trifolium arvense L.
(Rabbit-foot Clover.)
Trifolium hybridum L.
(Alsike Clover.)
Trifolium Kingii.
Trifolium pratensis L.
(Common Clover.)
Trifolium procumbens L.
(Hop Clover.)
Trifolium medium L.
(Mammoth Clover.)
Trifolium repens.
(White, or Dutch Clover.)

THE ARBORETUM.

This was started in 1873, and from time to time has been noticed in former reports. This spring a small piece on the south side, consisting of about a third of an acre, was planted to white pines, Norway spruces and box elders, alternating, the plants in rows four feet apart. The arboretum is growing more and more interesting, and is a favorite place for many who are interested in forestry.

For most of the report regarding the experiments begun at the college, I am indebted to my assistant, Eugene Davenport, who has shown great interest in the subject and has proved himself an accurate and careful experimenter.

W. J. BEAL,
Botanist of the Station.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1889.

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REPORT OF THE VETERINARIAN.

To the Director of the Michigan Experiment Station:

SIR—Since submitting my last report I have devoted considerable time to the study of micro-organisms, observing their development and other peculiarities. While watching the changes that occur in certain animal excretions when exposed to ordinary atmosphere, I was one day engaged making an examination of the fæces of a horse with the aid of a microscope, when I was somewhat surprised to find an exceedingly lively little creature, performing very energetic serpentine movements in the field of the instrument.

I followed the above exhibition up by making daily examinations of the excretions of the horse from which the specimen was obtained, and in nearly every instance where the examination was made, I found a variable number of immature whip-worms (oxyuris curvula), for such they proved to be. In one instance I counted thirty-four wriggling in a field only one-twentieth of an inch in diameter, showing that they might readily infest the intestines in countless millions without being observed by ocular examination, unaided by a magnifying power.

On measuring one of the little creatures, I found it to be the one-sixtieth part of an inch long, and about the one ten-thousandth part of an inch in diameter; so we see why it would be next to impossible to discover their presence in the fæces by the unaided eye.

On inquiry into the history of the horse from which these worms were obtained, I learned that it was subject to frequent attacks of a disease known as spasmodic colic, and that the attacks came on, from time to time, without any apparent cause. With this account of the animal, I told the groom to watch the horse carefully to see if it passed anything of an unusual nature along with its fæces; but was not surprised some time afterwards at being told that everything appeared to be all right, as far as the appearance of the fæces was concerned, but that once in a while, besides the colic, there was a tendency to diarrhœa. After watching this case for some months, I concluded that the enteric irritation was due to these invisible parasites, and treated the horse accordingly.

With this case before me, I concluded to examine the fæces of horses affected with colic—that is, when the symptoms are produced without any apparent cause—and have been gratified to find in those cases that I examined with the microscope all showed plainly the presence of the immature worm. I regret somewhat that I have not been able to examine the fæcal matter of a greater number of horses, but this, no doubt, will be done in course of time, as I do not intend to lose sight of what has already been brought under my notice; besides, the examination is so easily made, that I

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am in hopes others interested in the welfare of our equine favorites will follow it up and report their findings to this department of our station. I am aware that mature whip-worms often cause colic in horses, but it had never occurred to me, nor have I ever heard it suggested, that the immature, or microscopic creature, would produce such severe symptoms as I have seen.

The manner in which I now proceed to make the examination, is to take a small particle of the fæcal matter to be examined and place it on a slide, then drop the smallest quantity of water that will cover it on steadily, and examine under a three-fourths inch objective or first-class pocket lens; the worms, if present, will soon show themselves by their erratic movements. I have found them liveliest in fresh specimens, although they will live, even in the outside world, for some days.

With regard to the destruction of the parasites, I have not had an opportunity of experimenting very extensively; indeed, it may not be necessary, as I think they will yield to most vermifuge forms of treatment. I will add, though, that I have experienced very beneficial results from the administration of quinine and chlorate of potash. The procedure which I adopted was to give fifteen grains of sulphate of quinine mixed with two drachms of chlorate of potassium. This dose was given in the food three times a day and continued for four days.

ACTINOMYKOSIS.

During the winter months of the present year the disease known conventionally as Lumpy Jaw (*Actinomykosis*) was frequently brought under the notice of the people of Michigan, as well as other States, and as I am not aware of its ever having been investigated in this country, and as there are certain features of the disease that I am not aware have been investigated in any part of the world, I recommended to the board of conference of the Michigan Experiment Station that the veterinary department of this station be instructed to investigate this complaint, and that the investigation be directed: First, towards the cause of this disease; second, to determine if it is transmissible from animal to animal, and the circumstances that are most favorable to its transmission; third, to determine, as far as possible, what animals are most susceptible to the complaint; fourth, to determine, if possible, if the poison will grow upon grass, or other aliment when exposed to the sun's rays; fifth, to test the effect of cooking upon it, and determine what temperature it requires to destroy the poison.

With regard to the first part of this investigation, I will say that during the last few years (in our own time) transatlantic investigators have discovered a radiating fungus composed of a number of little club-shaped bodies, arranged in such a manner that they have been called *actinomyces*. These, when transmitted to other animals under favorable circumstances, are said to reproduce themselves, and thus cause *actinomykosis* in the other animal.

In carrying on this work it was my desire, first of all, to grow these *fungi* in some artificial culture medium, then transmit the artificial preparation to some animal, and watch the result; and for this purpose I procured some tumors, supposed to be composed in part of ray fungi or actinomyces, and inoculated certain culture fluids, as well as solid culture material; but up to the present time I have not been able to produce an artificial crop that

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would reproduce itself in another medium. I learn from experience that these microbes are not easy to grow, but trust that in the near future I will have discovered a medium that will reproduce them more rapidly, and thus facilitate further investigation in this important disease, and enable me to report more elaborately upon it ere long.

In closing this brief report, I have to express a feeling of gratitude for help rendered me by Assistant Mayo, D. V. S., who devoted much time to the details of the experimental work.

I am, sir,

Yours obediently,

E. A. A. GRANGE,

Veterinarian to the Michigan Experiment Station.

AGRICULTURAL COLLEGE, *June 30, 1889.*

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EXPERIMENT STATION BULLETINS.

NO. 43.—WEATHER SERVICE DEPARTMENT.

ANNUAL REPORT OF THE DIRECTOR, AND RAINFALL CHARTS OF MICHIGAN.

MICHIGAN WEATHER SERVICE,
IN CO-OPERATION WITH THE U. S. SIGNAL SERVICE,
OFFICE OF THE DIRECTOR,
Lansing, Mich., January 17, 1889.

Hon. FRANKLIN WELLS, *President State Board of Agriculture, Constantine, Michigan.*

SIR—I have the honor to submit the following report of the work of this service for the year ending December 31, 1888.

Instruments.—The instruments of the service are all in good condition, except one barometer, broken December 25, and one maximum thermometer, also broken in December.

Instruments are now in the hands of observers in all the counties, except Alger, Cheboygan, Gogebic, Iron, Missaukee, Presque Isle and Luce. Observers will be appointed and instruments will be placed in these counties as soon as volunteers can be secured.

Railway Weather Signals.—The weather signals have been regularly displayed during the year on the baggage cars of twenty-six trains of the following roads:

Detroit, Grand Haven & Milwaukee Ry.; Chicago & Grand Trunk Ry.; Port Huron & Northwestern Ry.; Michigan Central Ry.; Port Huron Division Grand Trunk Ry.; Grand Rapids & Indiana Ry.; Chicago & West Michigan Ry.; and the Pontiac, Oxford & Port Austin Ry.

This method of displaying the weather indications to the people of the State has been very satisfactory and should be extended to the other railroads of the State, as far as possible. This system was extended to as many trains

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during the year 1887, as the number of sets of signals would admit; there was $200 appropriated for this purpose, all of which was used in placing the 26 sets of signals on the trains, and the service could have been extended if more sets of signals had been available. I would recommend that six more sets be made for the purpose of extending this service to roads that are not as yet supplied, and will carry the signals on their trains regularly. Instead of having a special appropriation for this purpose, I would suggest that the amount for "incidental expenses" be increased slightly and the necessary amount taken from that fund.

In this connection the director takes pleasure in expressing the thanks of the service to the following managers for their hearty coöperation in having these signals regularly displayed on their trains: A. B. Atwater, General Superintendent Grand Trunk System; E. C. Brown, General Superintendent Michigan Central System; J. M. Metheany, General Superintendent Grand Rapids & Indiana Ry.; J. K. V. Agnew, General Superintendent Chicago & West Michigan Ry.; I. R. Wadsworth, General Superintendent Port Huron & Northwestern Ry.; James Houston, General Manager Pontiac, Oxford & Port Austin Ry.

Many farmers have expressed to the directors their satisfaction of the manner in which thse signals have been displayed during the year.

Weather Signals.—At the date of my last report, there were 142 stations displaying the weather signals, the number at the close of the year was 106, a decrease of 36 stations. The cause for this decrease in the number of stations is for two reasons: First, the displaymen neglect in many cases to render the monthly report required by the regulations of the service, and therefore, the "indications" were discontinued for non-compliance with the regulations. The number is being reduced so that there will be only those stations that do render this monthly report regularly; the second reason is, that when the first set of flags are worn out, it falls on one or two persons to purchase a new set where the whole town was interested in purchasing the first set, and consequently the one or two on whom this burden falls do not desire to do all that is required for the benefit of the citizens of the town where the signals are displayed.

To obviate this difficulty, I believe it would be of advantage to all, for the service to purchase the flags and thus control the display in a more satisfactory manner. This method has been adopted by the Pennsylvania service with success.

The flags could be obtained much cheaper by the quantity than by purchasing them by the single sets, and $700 would be sufficient to purchase 100 sets of signals, which number would be all that would be required during the next two years.

Voluntary Observers.—The director takes great pleasure in stating that corps of observers have accomplished more in building up this service than any other class; to them the service owes the vast amount of data that has been published during the past two years, and for the very substantial basis that the service has now attained. These observers have, as a rule, been very faithful in taking the observations and forwarding them to the central office promptly at the close of the month of which they were a record, and have greatly aided the director in proving and computing the reports for publication. When it is understood the amount of work these observers give to the service each month in taking

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the three observations each day and correcting them ready for use, and that these observations have to be taken every day in the month, it will be readily seen that they are entitled to a great deal of credit for the faithful performance of the work which brings them no remuneration for the time given to the work.

In this connection I would recommend that an "instrument shelter" be furnished to each of the voluntary observers, so that the shelters will all be uniform and better results be obtained thereby, and as a means of better protection to the imstruments of the service. Another important reason for this move is, that when an observer is supplied with instruments, it takes from one to two months before the observer has a shelter made so as to make a satifactory report to this office. A shelter sent with the instruments, ready to be put up, would obviate the difficulty, and would secure to the service good observers, where it is now impossible to do so, more for the reason that the observer does not understand exactly the plan for the shelter, and that he may not have the ready money to expend to construct one properly. The director believes it would be more economical in the end to furnish the shelter direct than to have the voluntary observer furnish it. The matter of paying a small amount to each observer for each monthly report has been recommended, and I believe it to be of some importance that it should be done, as a means of securing better and more continuous reports. There are on the list of the service 103 voluntary observers, and of that number 56 make a continuous report for the entire year, the remainder having omitted from one to two or more months, so that the reports had to be thrown out of the annual summary of observation. I believe that a small compensation will in a great measure obviate the difficulty. It is not recommended that the observers be paid a regular salary yet, but a sum that would, in a measure, reimburse them for the money paid out to place the station in shape for making regular reports. Some observers have paid out as much as $50 to have their station in the best possible condition for making the reports. The value of the reports of these observers should be recognized in some substantial manner, and the director believes that the one recommended would be satisfactory to the observers.

The reports of the observers are, upon receipt at the central office, carefully computed, proved and entered on the appropriate tables, for publication each month by the Secretary of State in the crop report.

There has been an average of 75 voluntary observers reporting each month during the year, and since July 1, eight of the U. S. Service. These reports contain the following data: Record of barometer, temperature, relative humidity, precipitation, wind, clouds and the state of the weather at each of the three observations.

Weather-Crop Bulletin.—This bulletin, which was inaugurated May 7, 1887, and continued during the growing season, was published each Saturday morning from March 4, to September 29. As has been stated, this bulletin in no way encroaches upon the prerogatives of the Secretary of State, but simply gives the condition of the growing crops for the past seven days, and what effect the weather has had upon them. Seventy-five copies were issued weekly, and the information given to the daily papers of the State was also published in many of the weekly papers. The information thus given placed the condition of the crops before the people every week, and has been of no little value to the agriculturists of the State. It is the

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intention to continue the bulletin during the coming season and enlarge somewhat the amount of information that was supplied during the past year.

Temperature Normals.—During the year the director has finished the work of compiling the mean daily temperature for each section of the State, and has had them published with the monthly reports. The work has occupied the spare time of the office force during the better part of two years, and it is with satisfaction that the director announces this work completed. These normals will allow of a comparison of the mean daily and monthly temperature of the State, and will be of great value to the people in determining the temperature of the locality in which they reside, and also in determining what trees or cereals are best adapted to their localities. These normals were used during the past season, in connection with the crop-bulletin to determine the departure each week of the mean daily temperature from the average, and the consequent effect upon the crops.

Precipitation Charts.—During the year the director has had compiled the average monthly rainfall for each section of the State, and has had the figures published in the monthly report. Believing that the information thus compiled could be better shown by being charted, the director made a chart of the State showing the average monthly rainfall for each month and for the year. These charts were made up from the observations of 13 years, and about 4,000 reports were examined and proved to obtain the data. There was also made the charts of the monthly and annual rainfall for the present year which are to accompany the normal charts. The board, at its regular meeting, December 11, authorized the director to have these charts photo-engraved. This has been done at a cost of $76.14 for the 26 charts, and they are now ready for publication. These charts will be of great value to the people of Michigan, as the rainfall can be readily compared with the normal and thus ascertain in each locality, whether the rainfall has been the average or not. In this connection the director would state that in September, 1887, he issued a circular calling for volunteers to take the daily rainfall, and in response he obtained 30 observers who have been furnishing valuable reports upon this important subject. These reports have been of the greatest service in making up these charts, as can be readily seen upon examination, and show conclusively the peculiarities of the rainfall in this State. This subject will receive the careful attention of the director during the coming year, and its close connection with the growing of crops.

Office Force—The office force consists of the director, and the assistant to the director, Mr. E. H. Nimmo. They have compiled all the vast amount of data that has come from this service during the year. I wish to recommend the work of Mr. Nimmo, who has proved a very efficient assistant, and has performed all work assigned to him with promptness and ability, and to his quick work is due, in a measure, the amount of work accomplished by the central office.

The service may be said to be now established, and if the favor with which it is received by the people is any indication of its worth, it has come to stay, and I would recommend that it be permanently established as it is now operated, under the control of the State Board of Agriculture.

In closing this report, the director desires to express his grateful appreciation of the hearty co-operation of the board, as a whole, and to the members individually, for their support has been of great value in carrying on the work of the service.

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The service was established February 3, 1887, and at the close of the time for which the appropriations were made, the director believes that every pledge then made has been fulfilled.

Very respectfully, your obedient servant, N. B. CONGER,
Sergeant Signal Corps, Director.

MICHIGAN WEATHER SERVICE,
IN CO-OPERATION WITH THE U. S. SIGNAL SERVICE,
OFFICE OF THE DIRECTOR,
LANSING, MICH., *January 15, 1889.*

Hon. FRANKLIN WELLS, *President State Board of Agriculture, Constantine, Mich.:*

SIR—In compliance with the resolution of the State Board of Agriculture, adopted December 11, 1888, I have the honor to transmit to the Board the series of rainfall charts of Michigan.

These charts are as follows: Rainfall charts January to December, 1888, and the normal rainfall charts for each month of the year, and the annual rainfall for the State.

In the preparation of these charts about 4,000 monthly reports have been examined, proved and used.

The normal rainfall has been compiled from the observations of thirteen years, and extend from 1876 to 1888.

The records previous to the establishment of this service in 1887, were obtained from the files of the State Board of Health, and the director desires to state that the service is under great obligations to Dr. Henry B. Baker, Secretary of the State Board of Health, for the loan of the records for the years 1876–1886. It would have been impossible for the director to compile the normal charts if these records had not been accessible. The records which Dr. Baker has had taken have been worth 11 years' careful observations to this service.

I believe that there are at present no charts of the kind in existence in Michigan, and I believe that they will be of considerable value to the agricultural and experimental interests of the State.

The service has been in operation now not quite two years, and in that time the director has compiled the daily normal temperatures for each section of the State and has had them published in the monthly reports of the service, and now the average monthly and yearly precipitation has been completed and charted so that it may be readily referred to, and with the monthly records of the precipitation, the condition of the staple cereals of the State may be more conveniently and surely estimated.

The data for these charts have been entirely compiled in the central office, and the charts were designed and drawn by the director. As each chart has been carefully scaled and shaded, it is not considered necessary to publish the figures from which the charts were prepared, other than are shown on each chart.

Very respectfully, your obedient servant,
N. B. CONGER,
Sergeant Signal Corps, Director.

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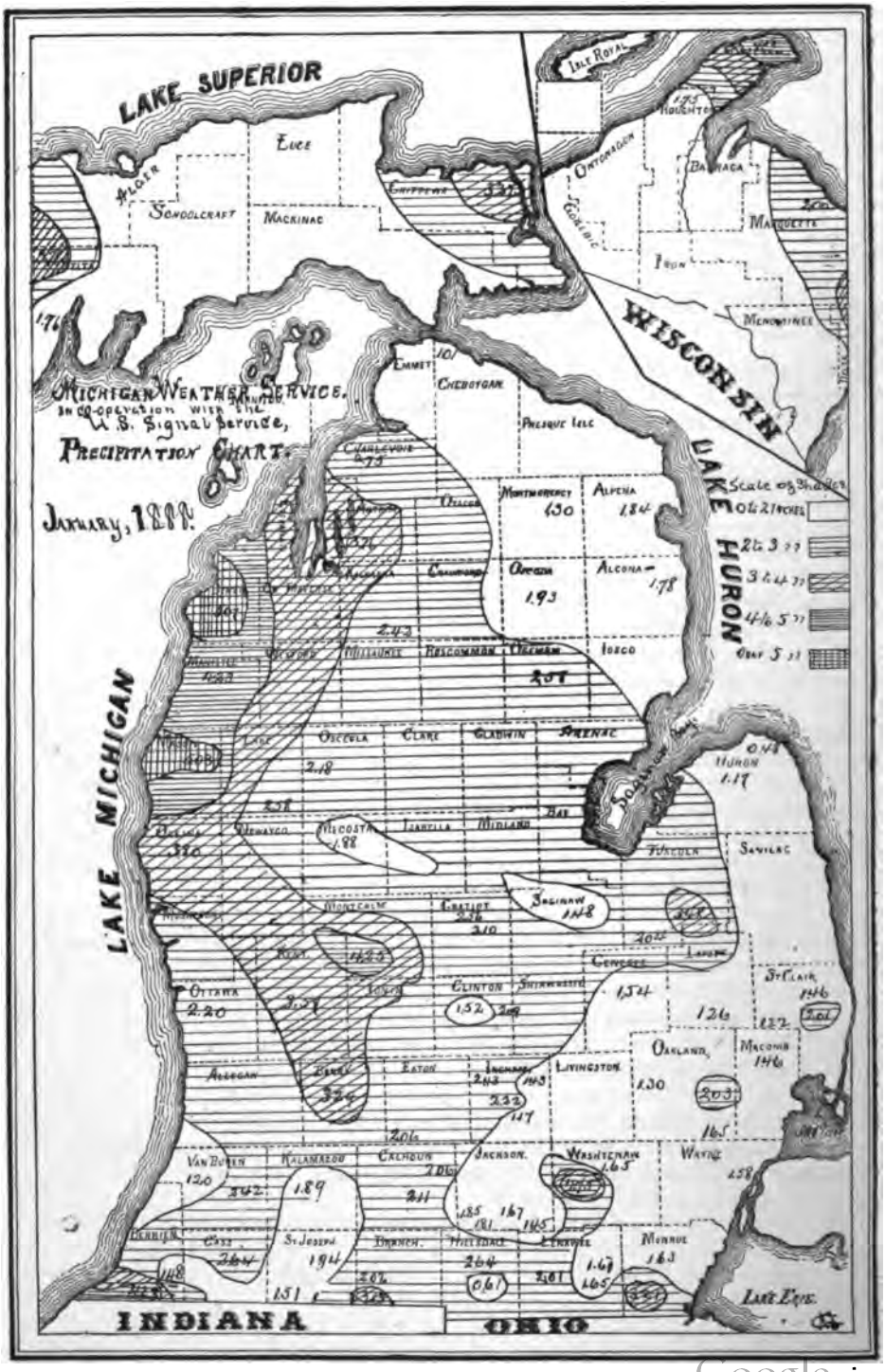

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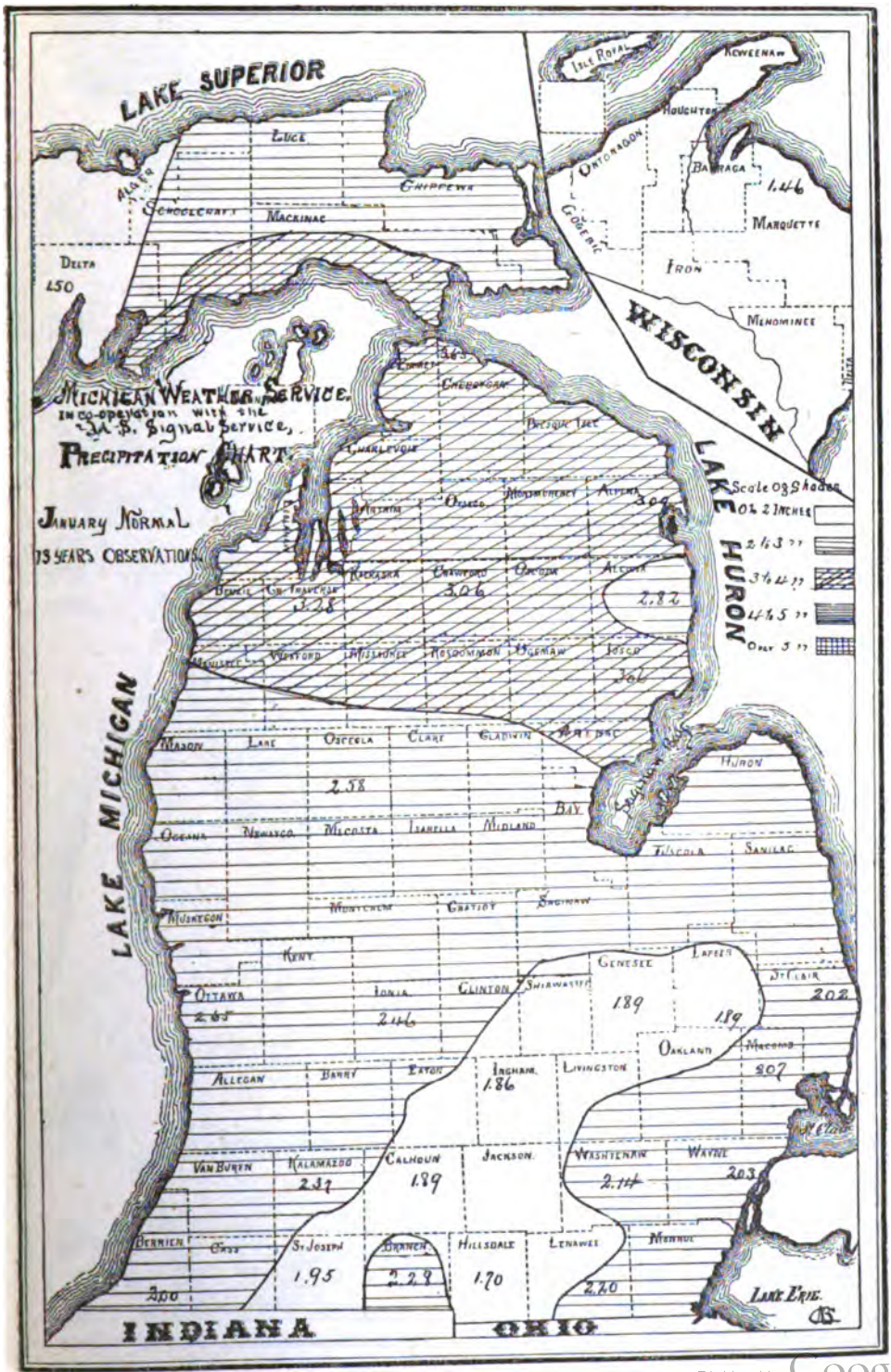

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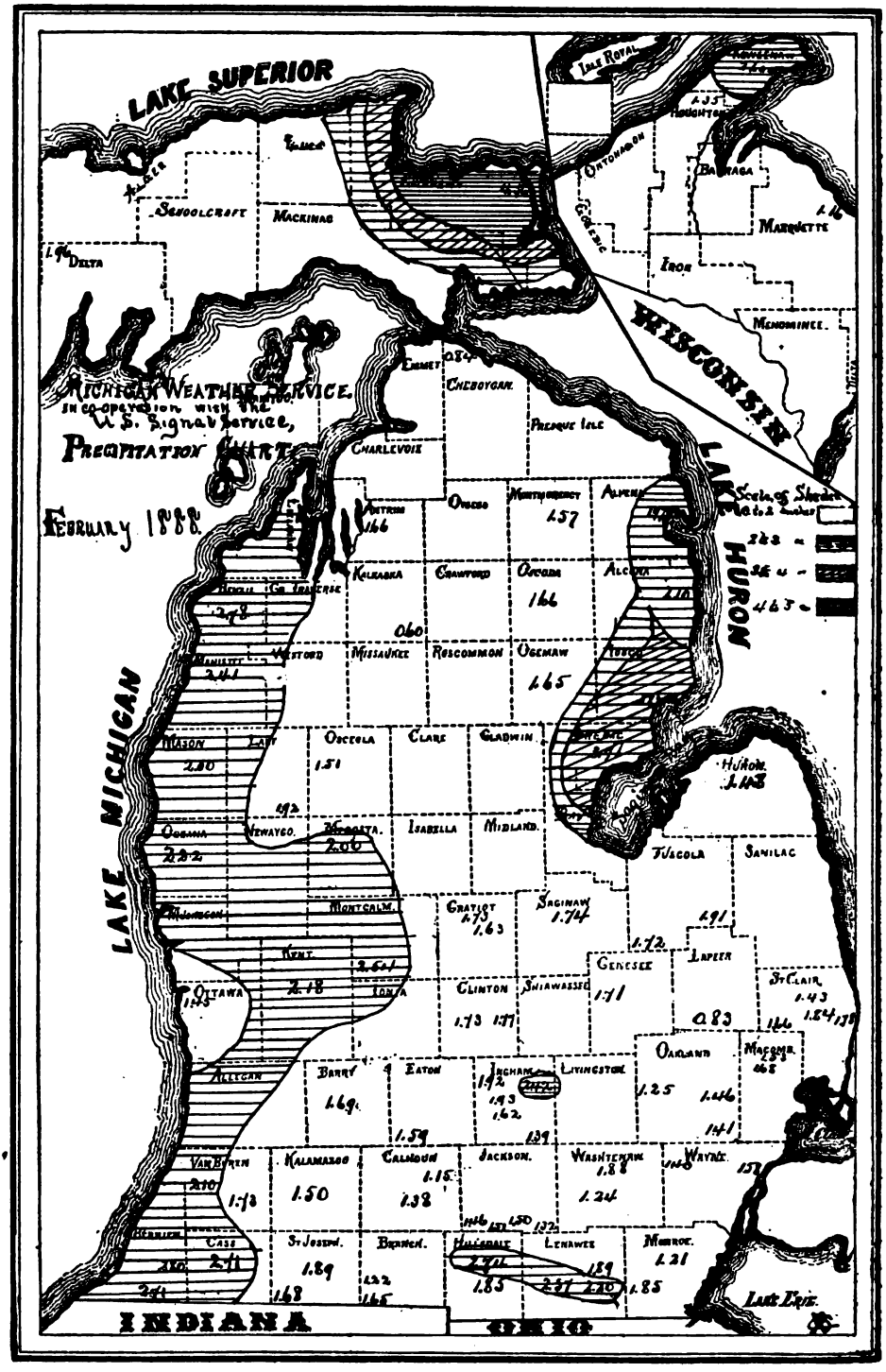

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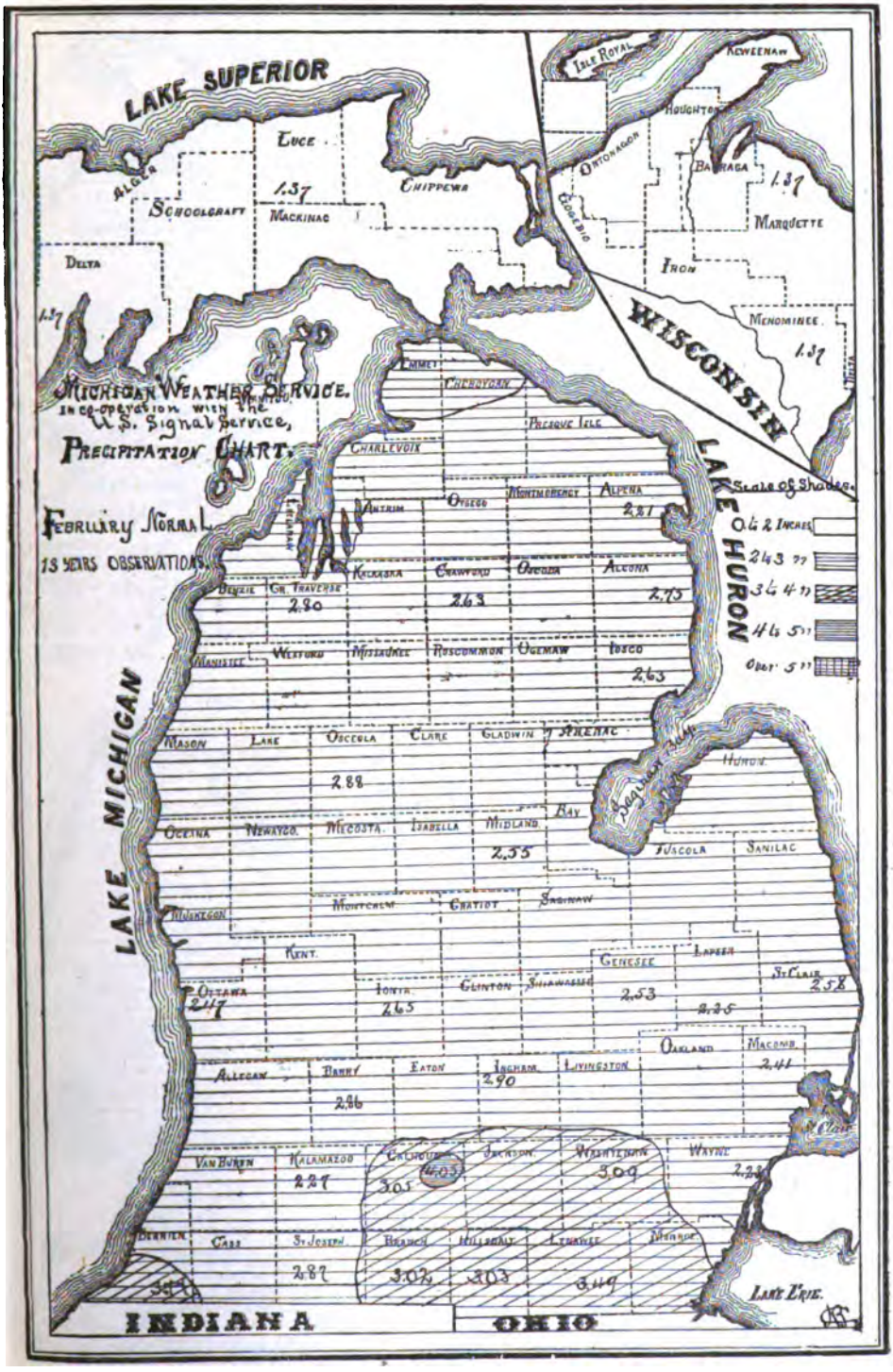

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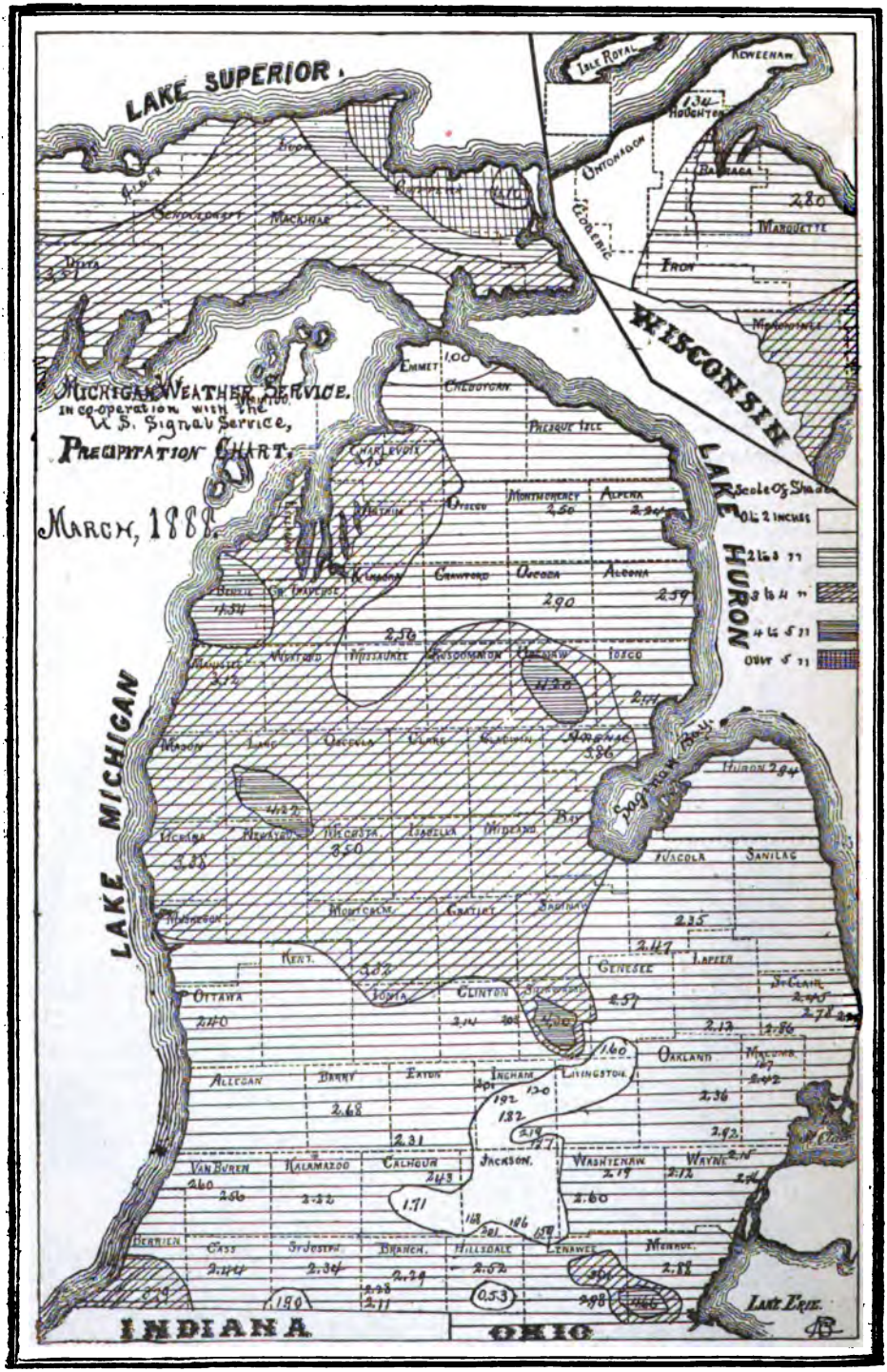

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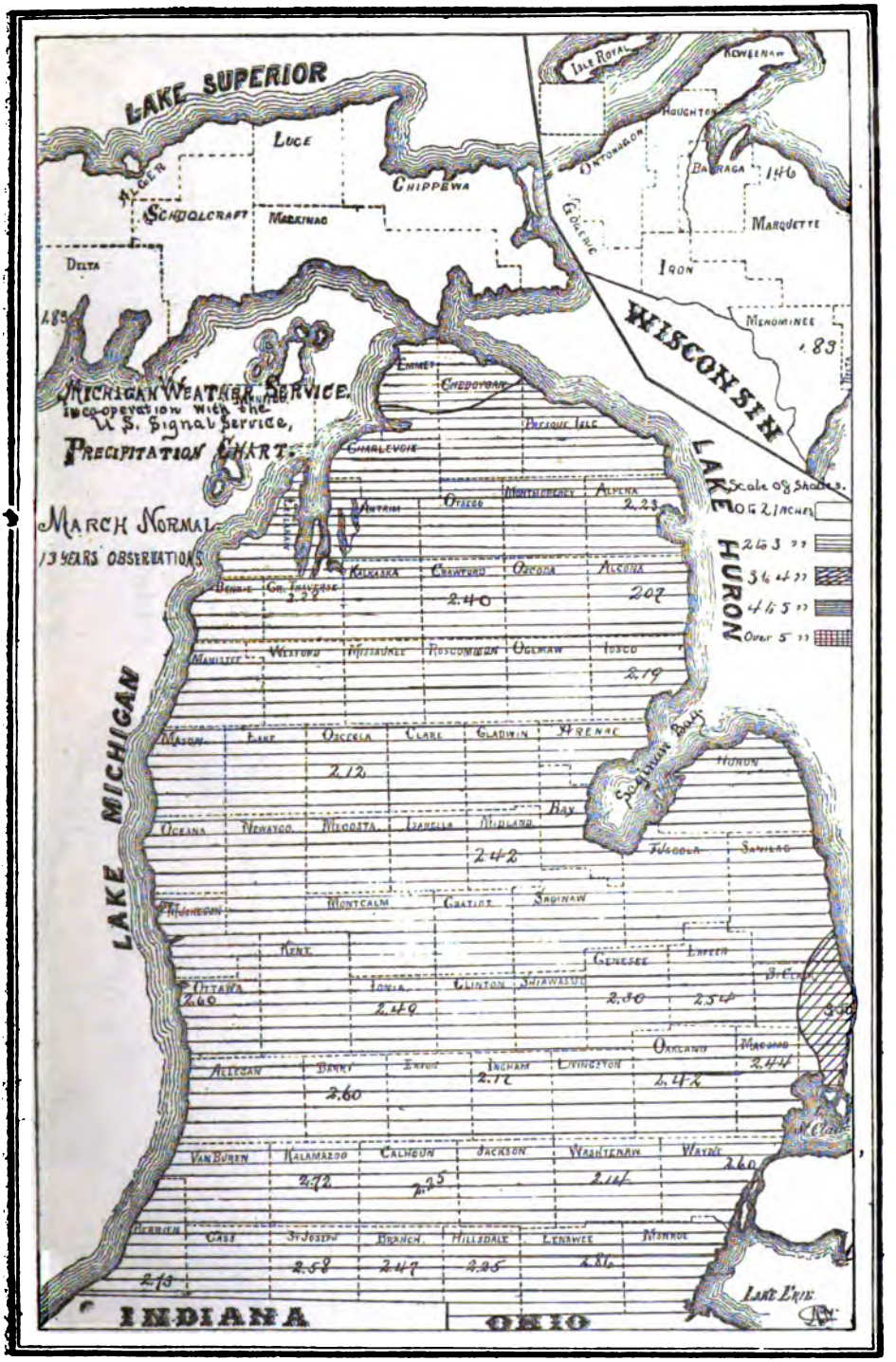

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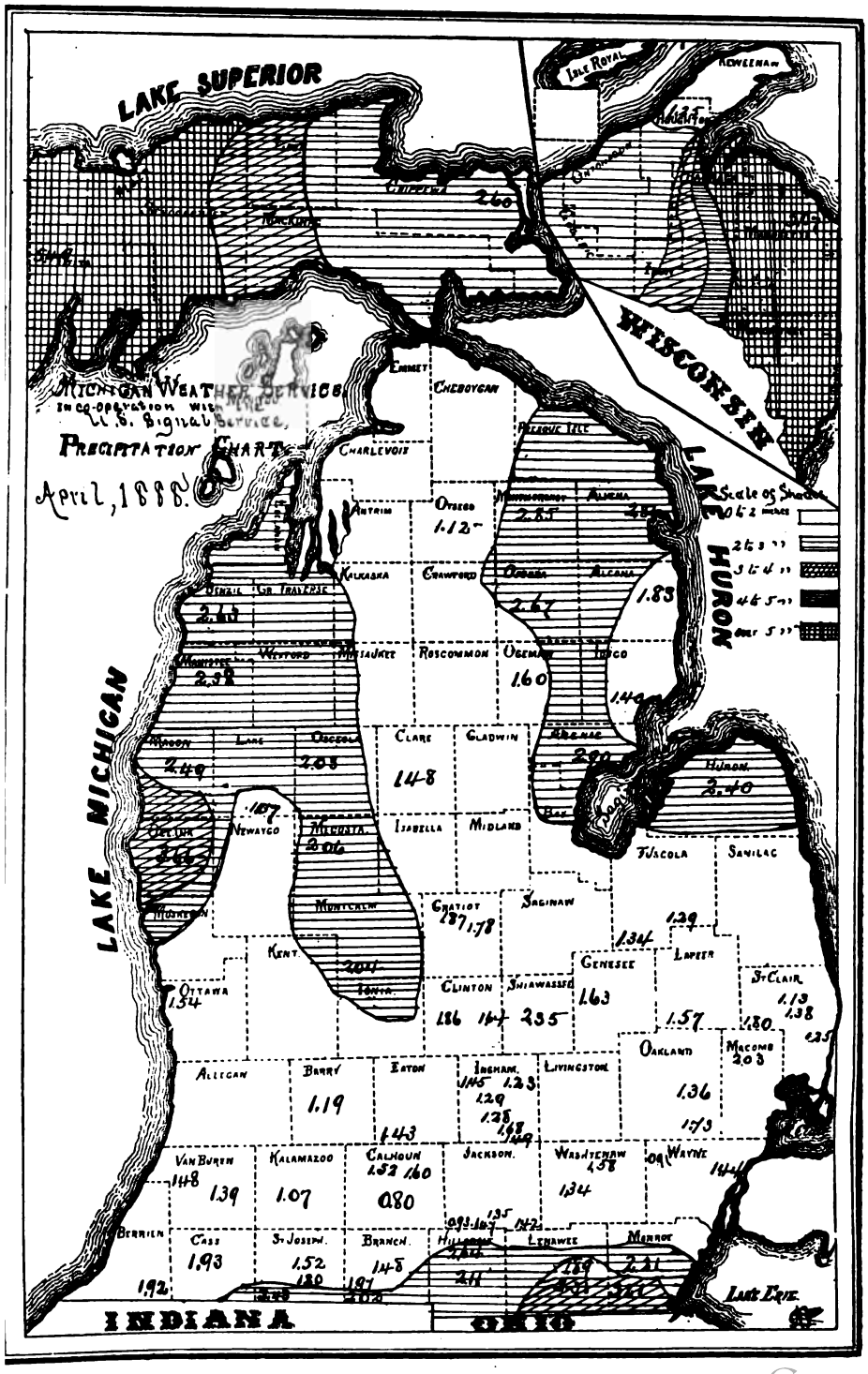

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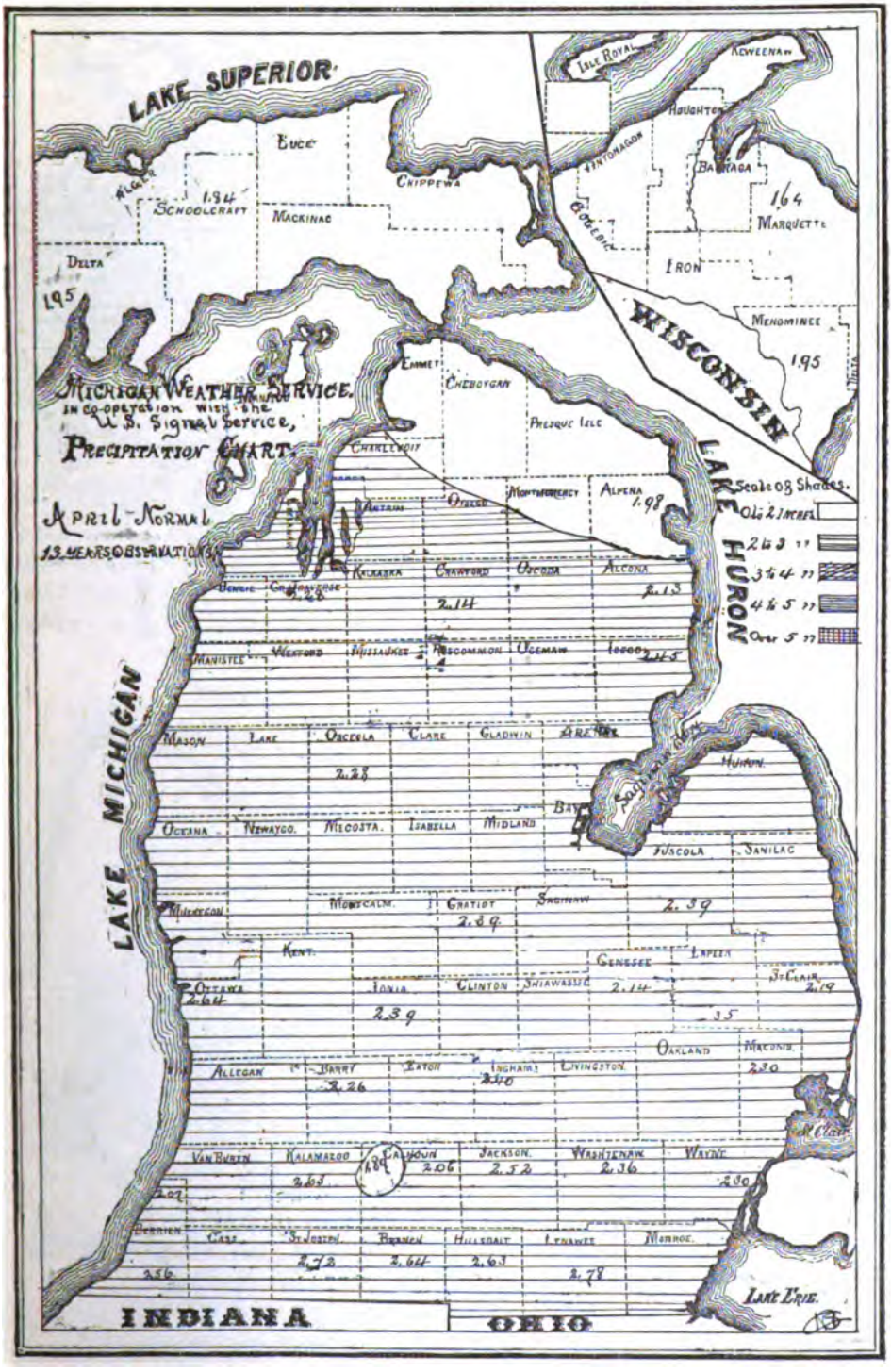

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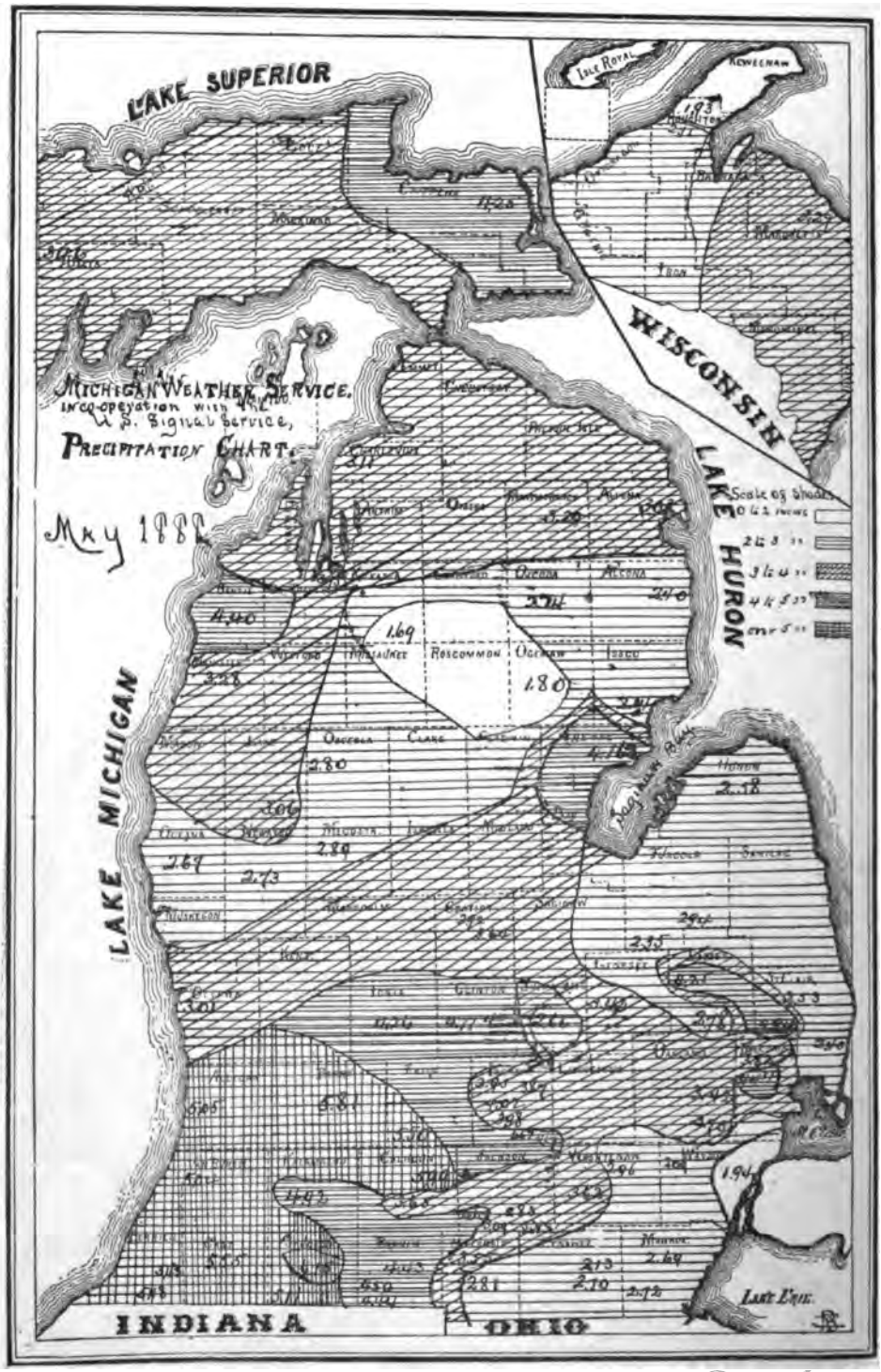

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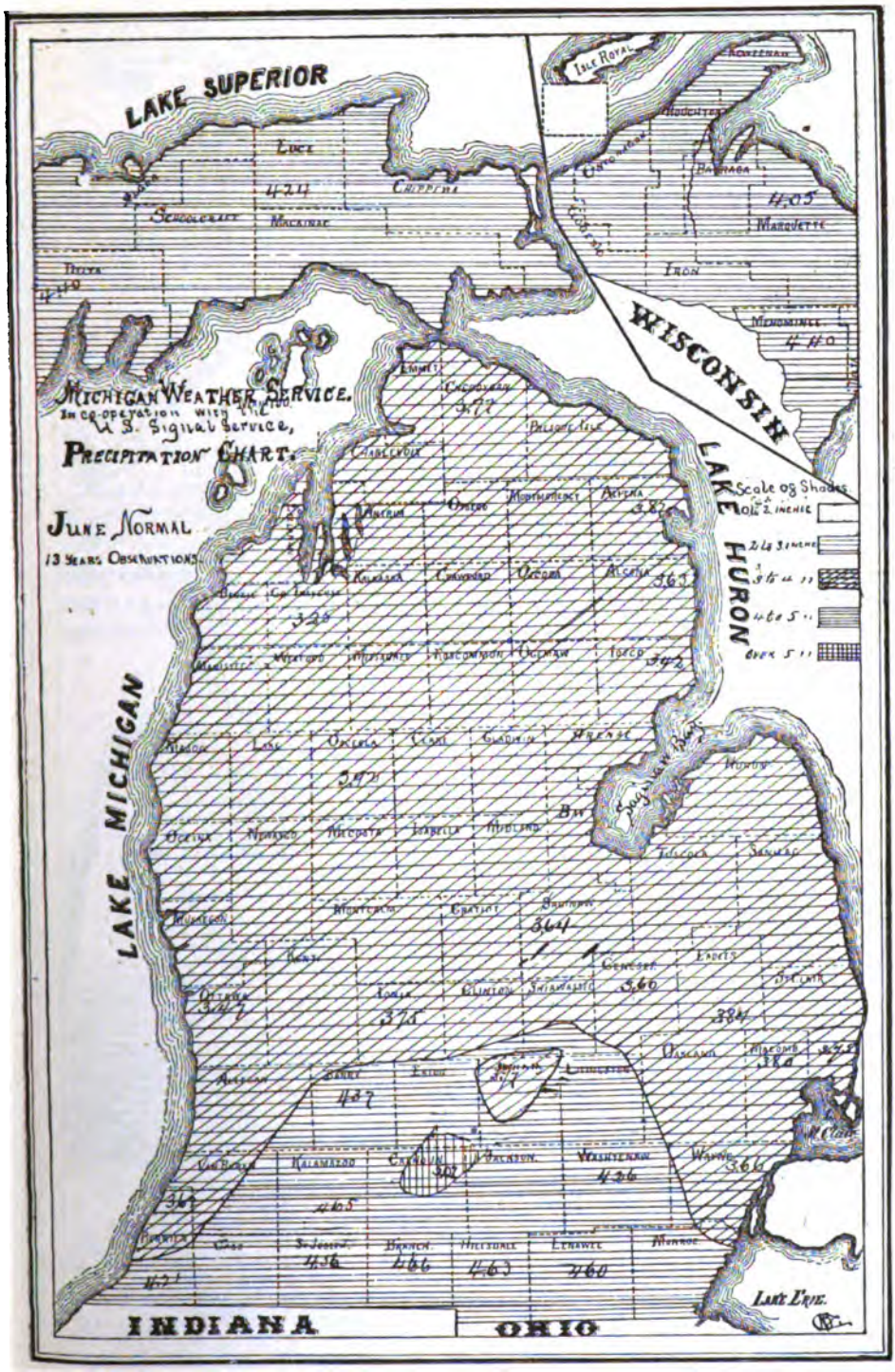

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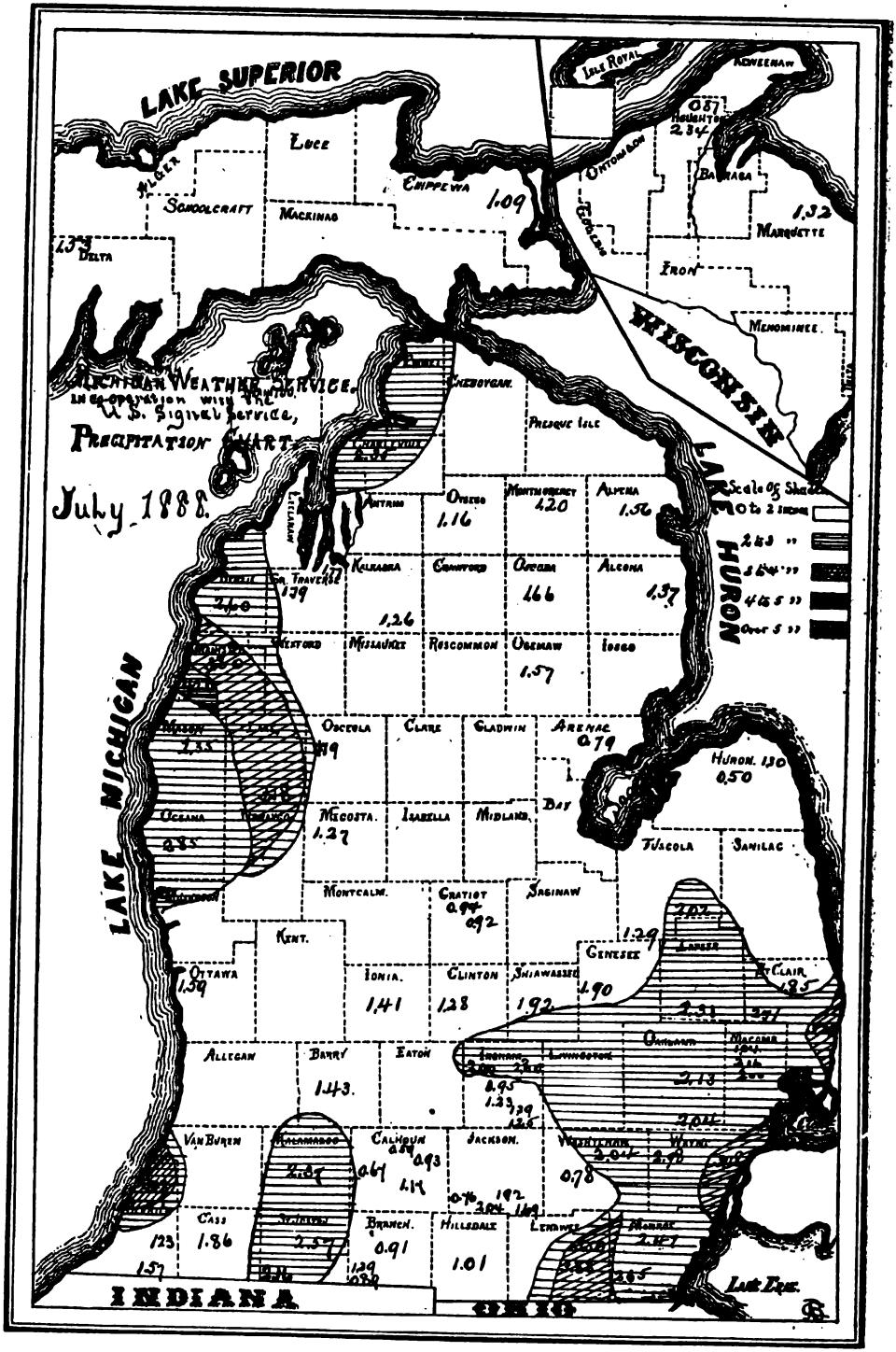

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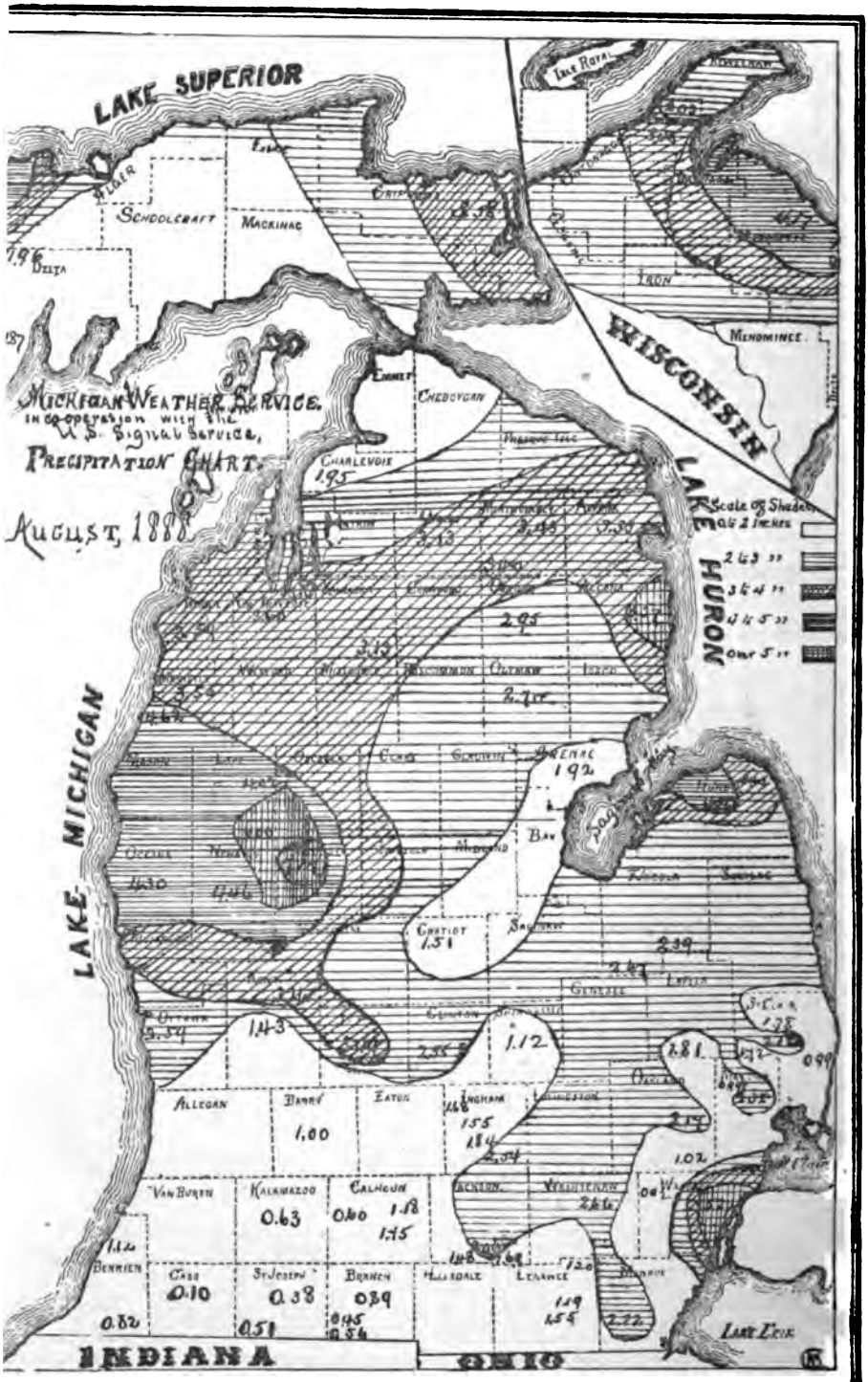

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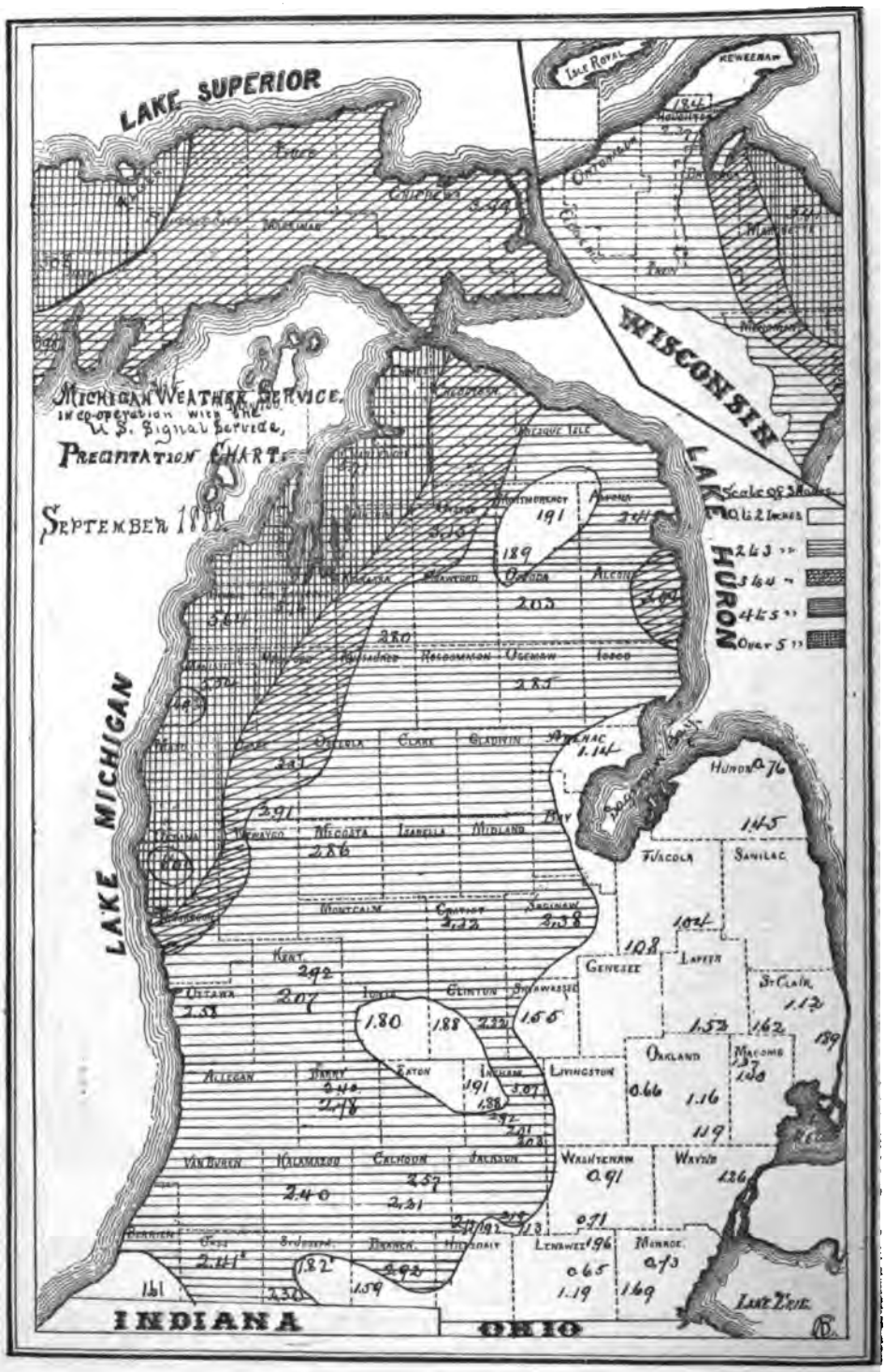
LAKE SUPERIOR
WISCONSIN
LAKE HURON
LAKE MICHIGAN
MICHIGAN WEATHER SERVICE.
IN CO-OPERATION WITH THE U.S. SIGNAL SERVICE.
PRECIPITATION CHART.
August Normal
13 Years Observations
Scale of Shading.
0 to 2 Inches
2 to 3 "
3 to 4 "
4 to 5 "
Over 5 "
Isle Royal
Houghton
Manistee
Menominee
Mackinac
Cheboygan
Presque Isle
Emmet
Charlevoix
Antrim
Otsego
Alcona
Iosco
Ogemaw
Roscommon
Oscoda
Alpena
Montmorency
Alpena
Alcona
Iosco
Ogemaw
Roscommon
Oscoda
Crawford
Kalkaska
Grand Traverse
Leelanau
Benzie
Manistee
Wexford
Missaukee
Roscommon
Ogemaw
Iosco
Alcona
Oscoda
Alpena
Presque Isle
Cheboygan
Emmet
Charlevoix
Antrim
Otsego



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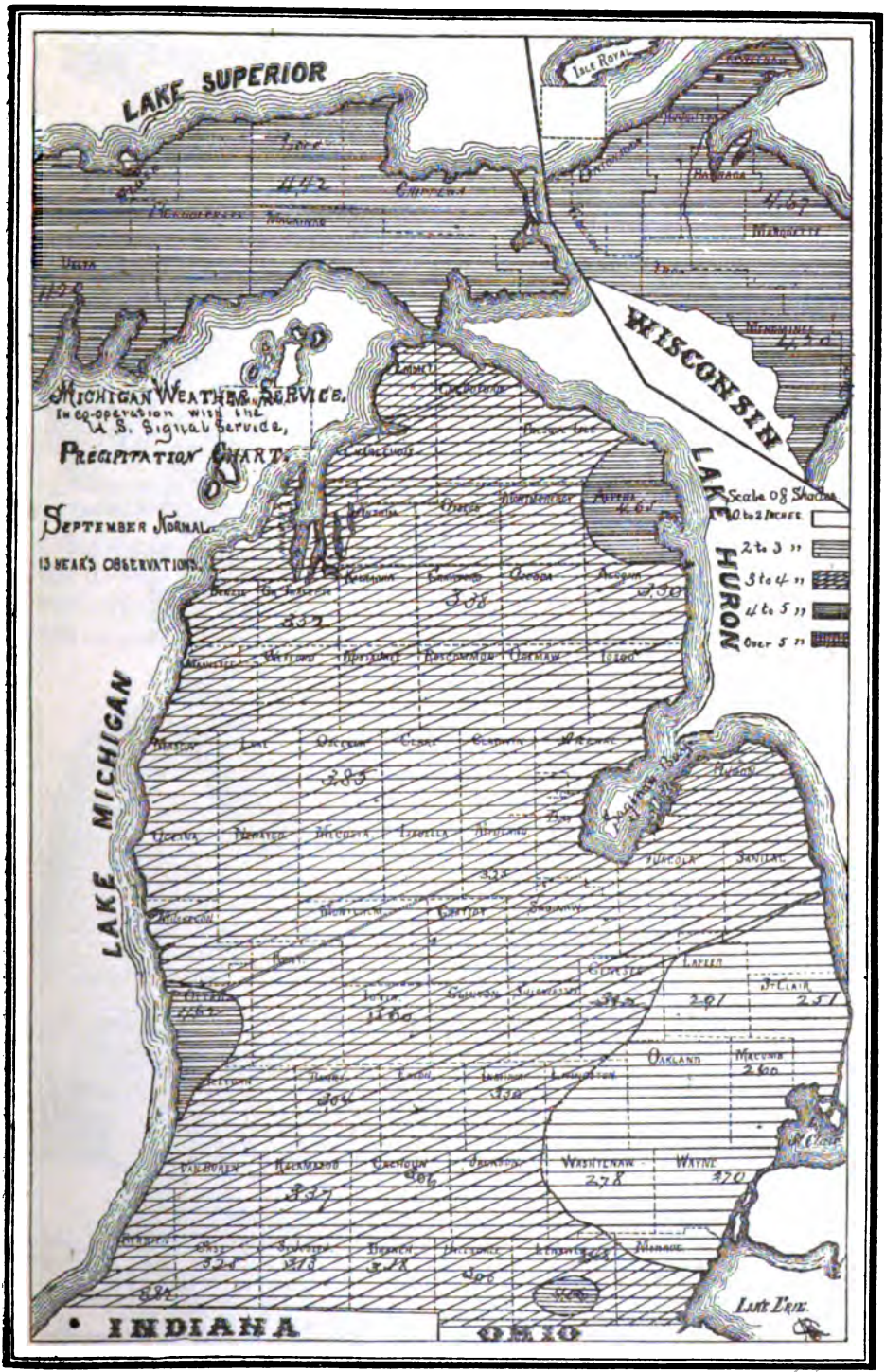

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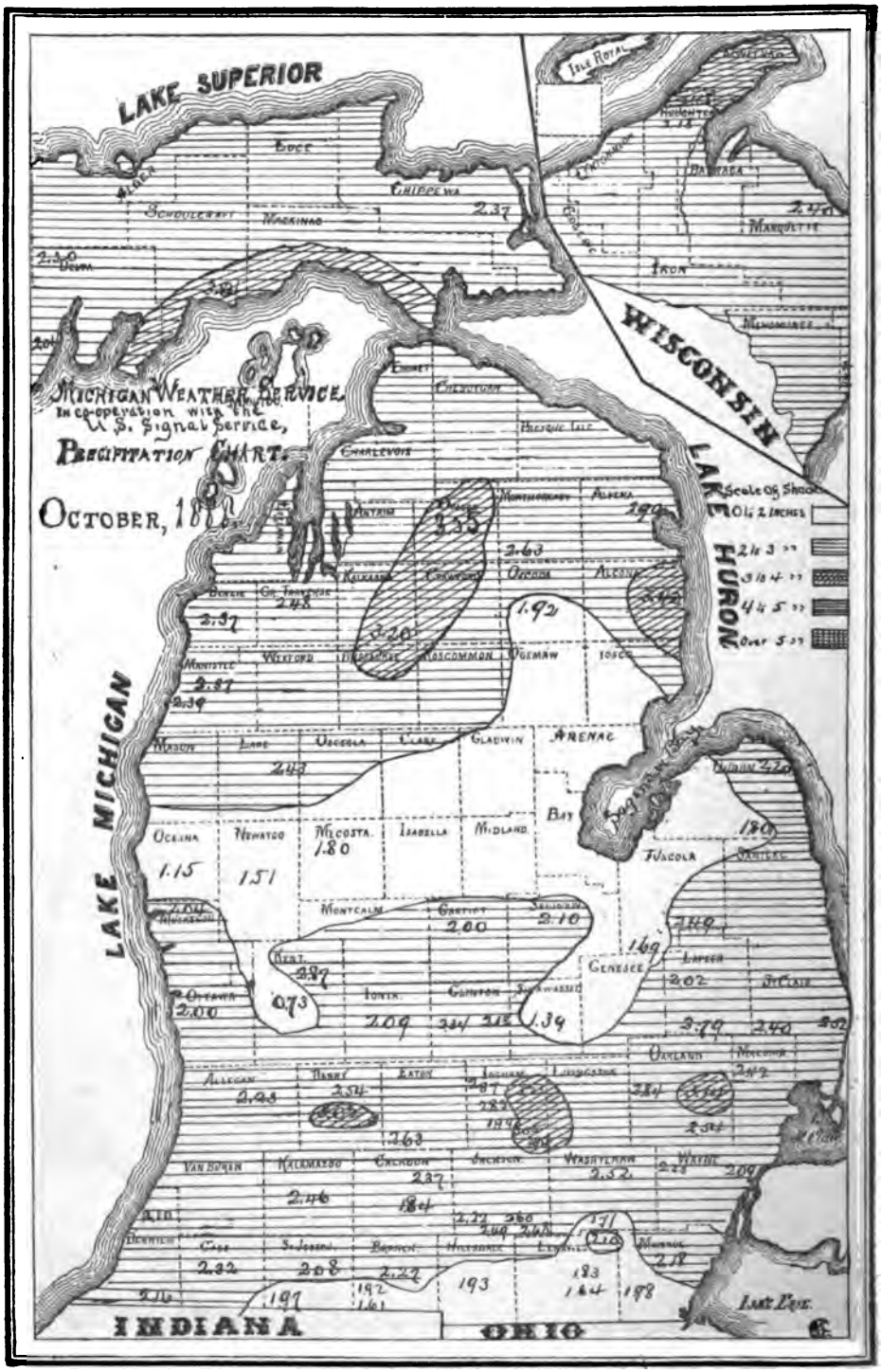

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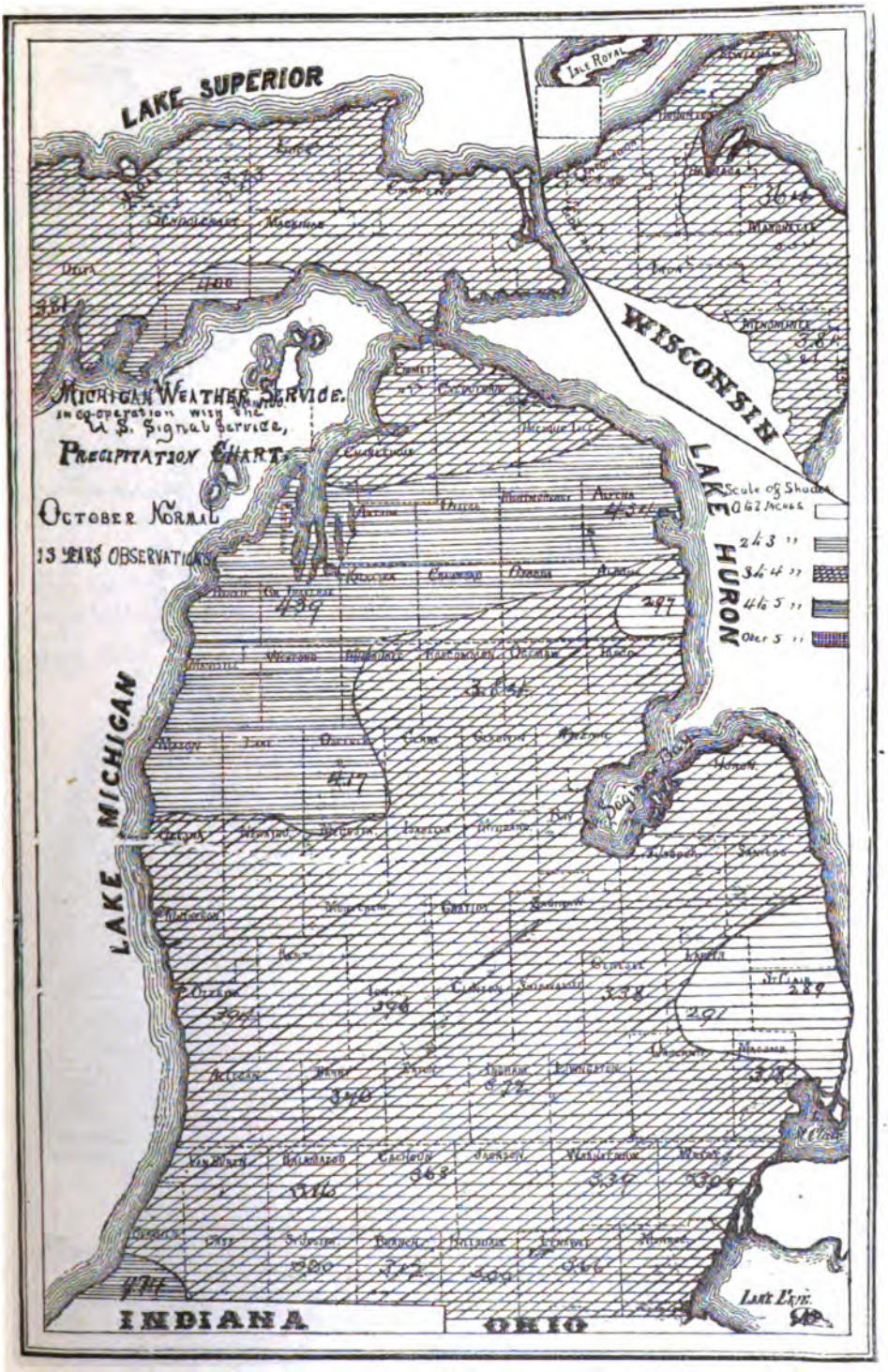

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LAKE SUPERIOR
Isle Royal
Keweenaw
Houghton
Ontonagon
Gogebic
Iron
Wisconsin
Menominee
Marquette
Schoolcraft
Mackinac
Chippewa
Emmet
Charlevoix
Presque Isle
Alpena
Montmorency
Otsego
Crawford
Oscoda
Alcona
Roscommon
Ogemaw
Iosco
Arenac
Huron
Bay
Saginaw
Midland
Gratiot
Tuscola
Sanilac
St. Clair
Genesee
Lapeer
Shiawassee
Clinton
Ionia
Oakland
Macomb
Livingston
Ingham
Eaton
Barry
Allegan
Van Buren
Kalamazoo
Calhoun
Jackson
Washtenaw
Wayne
Monroe
Lenawee
Hillsdale
St. Joseph
Branch
Berrien
Cass
Lake
Osceola
Clare
Gladwin
Isabella
Mecosta
Newaygo
Oceana
Muskegon
Manistee
Wexford
Missaukee
Kalkaska
Crawford
Otsego
Montmorency
Alpena
Presque Isle
Cheboygan
Emmet
Charlevoix
Antrim
Grand Traverse
Leelanau
Benzie
Manitou
Michigan Weather Service
In co-operation with the U.S. Signal Service
Precipitation Chart
December 1888
Scale of Shade
0 to 2 inches.
2 to 3 "
3 to 4 "
4 to 5 "
over 5 "
Lake Michigan
Lake Huron
Indiana
Ohio
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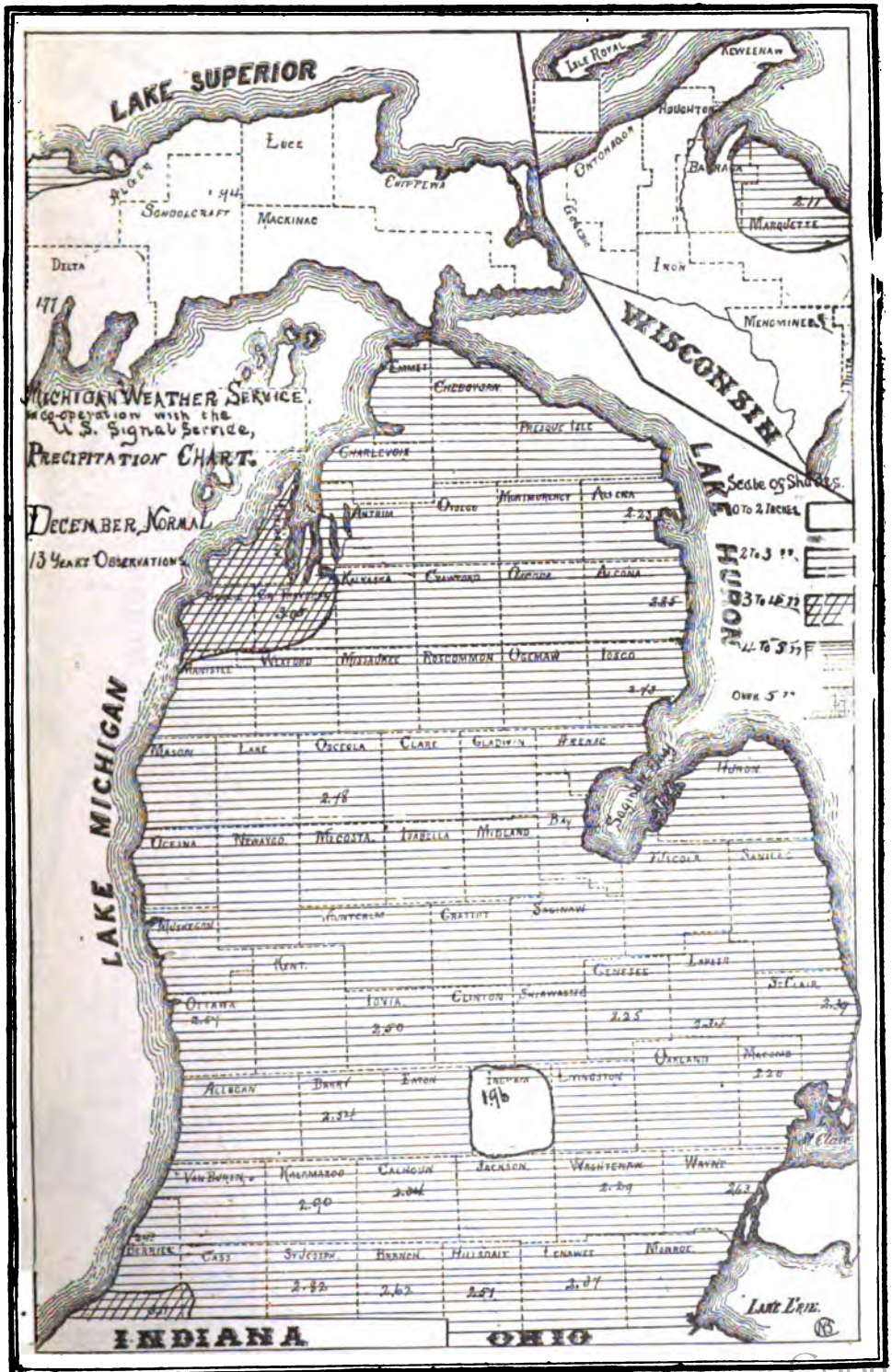

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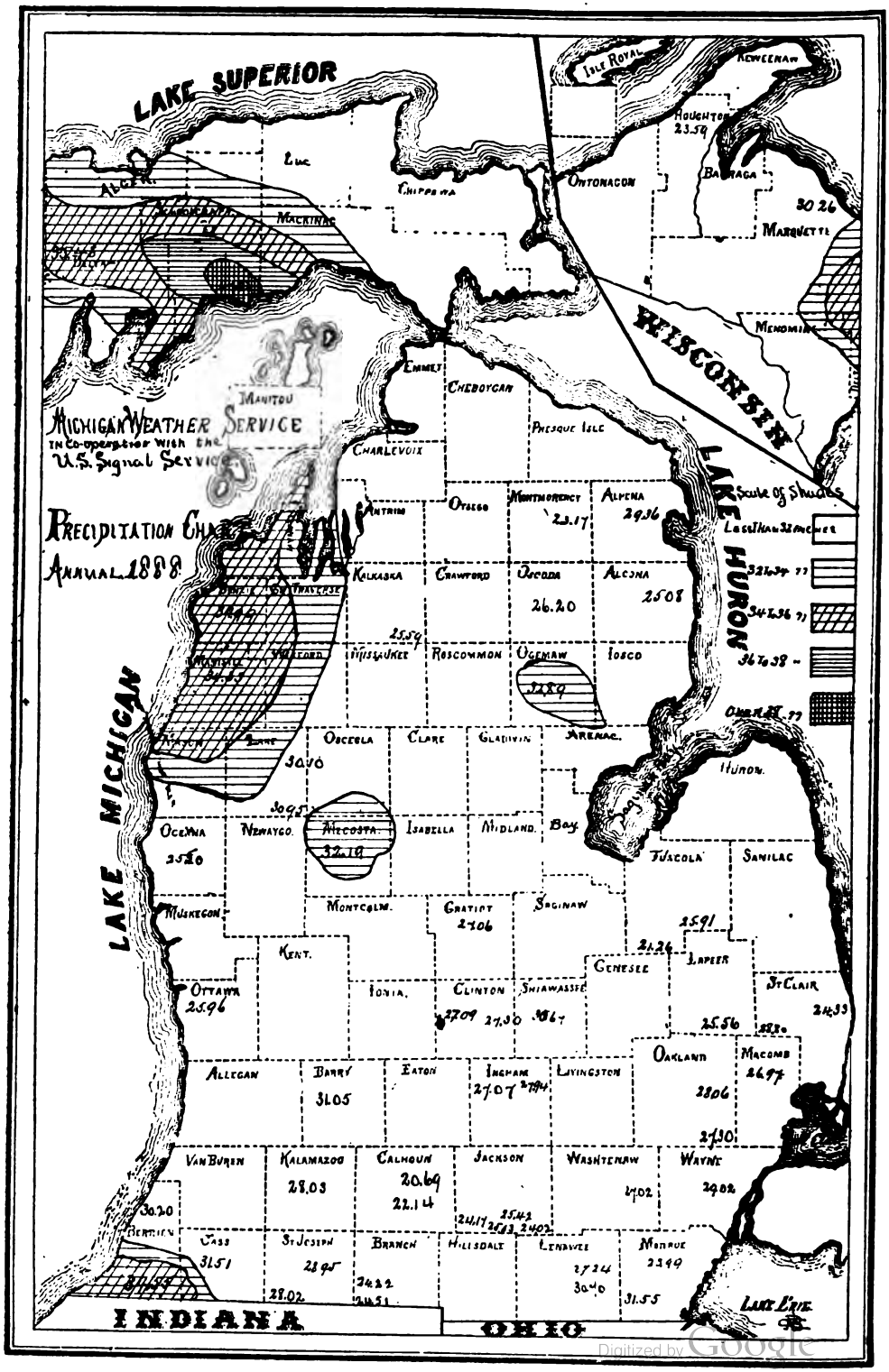

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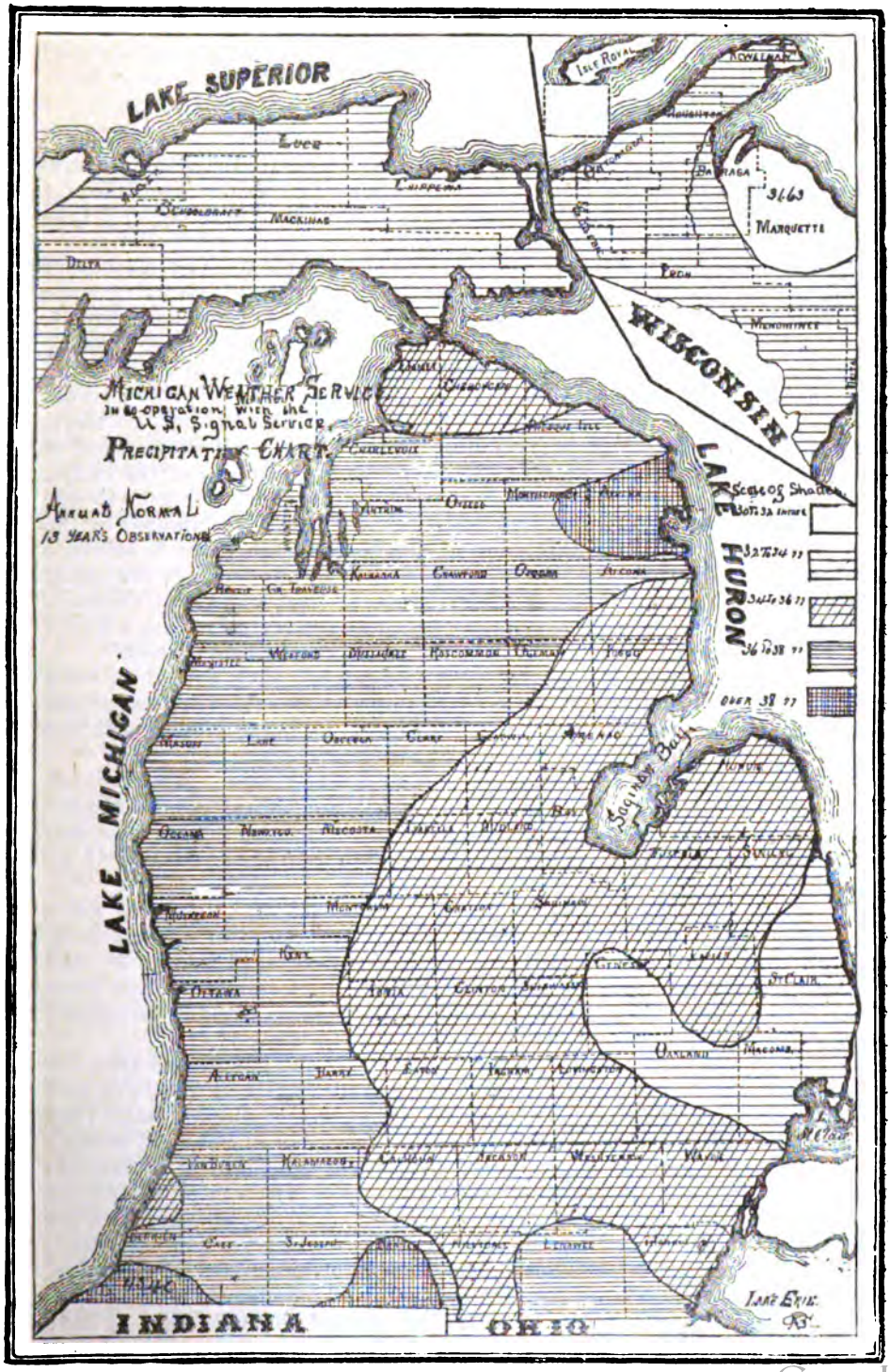

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NO. 44.—FARM DEPARTMENT.

FEEDING STEERS OF DIFFERENT BREEDS.

By request of the Michigan Galloway and Holstein Cattle Breeders' Associations, the bulletins heretofore published on the feeding of steers of different breeds are, in substance, published with this final report, as an appendix, so that the complete report of the experiment is contained in this bulletin.

The last report carried the steers to October 10, 1887. The November following they were shown at the Chicago Fat Stock Show, attracting some attention from those who were familiar with the object of the experiment, and who knew that the aim had been to keep them in a thriving, growing condition, as they were to be carried another year. To have had them in the pink of perfection at this time would have increased many fold the chances of failure in the last year's feeding. Some visitors, who could only see merit in animals carrying great masses of flesh, passed our exhibit with a kind of semi-patronizing air, if not a direct criticism on the leanness of the cattle. They did not stop for weights, which showed plainly that their growth was above the average. "Many men of many minds," and I was amused by the grim courtesy of a Kansas City gentleman who took the pains to return a bulletin that had been given him, with the endorsement: "While the object sought to be obtained is well worthy a trial, yet from exhibit at Chicago, allow me to suggest that if the feeding was done by scientific feeders it would be better for the animals to be turned over to the unscientific feeders."

But there were many thoughtful men who stopped long enough to learn what the exhibit meant, and were not slow to pronounce the work important and in the right direction. So that on the whole I was pleased with the results of the show.

The steers were a good deal worried in going to Chicago. Were delayed somewhat and crowded on the car, and it took them several days to recover what they had lost by the trip. Mr. Robert Tulis had them in charge, and was assisted at the show by sophomores W. J. Robinson of Detroit and O. A. Turner of Grand Rapids.

The steers, while feeding in the main well, did not make as great gains during the winter as I had looked for. They were thriving and vigorous, however, and, with a few exceptions, made some advance in weight each month. They were allowed the run of a small yard daily for some three hours, for exercise, and fed and cared for in the same manner as noticed heretofore.

On June 1, Robert Tullis, the trusty Scotchman who had looked after the steers since the feeding began, decided to go to his family in Australia, and June 15, Thomas Jack took his place, and had charge of the lot until they were slaughtered in Chicago. He has proved himself an efficient and reliable helper, and to his prompt and painstaking effort in carrying out my instructions, much of the credit of the final finish is due. He is in charge of the new lot just put in the barns for the second test. The last of May, when the pasture was "a full bite," we accustomed the steers to grass gradually, and, for a couple of months, they got a good portion of their feed in the fields, adjoining the barn. They consumed only a small amount of grain during this period, as reference to the tables will show, and but little hay. I have

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no doubt that a cessation of the grain ration, for a time, was beneficial, and that they fed to better advantage after this rest from dry food. They were placed in their stalls daily, however, and offered grain, but they consumed very little. As the drought affected the pastures, we soon had to return to full feeding in stalls, and up to the 7th of September, when the lot was shipped to Jackson, to the State fair, they had made fair gains.

The steers were shown at the State fair at Jackson; the next week at the West Michigan at Grand Rapids; and then at the Central Michigan at Lansing. They were away from the College on this trip four weeks continuously, and yet, so well were they cared for and handled, that, with one exception, they had more than held their own. They proved an attractive exhibit at the fairs. On account of the Central fair occurring at same date as the Ionia county fair, we were compelled to give up our plan to exhibit there, as we felt under prior obligations to our home fair. I wish especially to thank the officials of all these shows for courtesies extended.

In no month during the experiment did the steers feed to better advantage than the one after their fair trip up to the time of their shipment to Chicago, November 8, for the final exhibit at the Fat Stock Show, in charge of Thomas Jack, assisted by Sophomore J. R. Frank, of Rochester, Mich. The steers were in very good trim, not fat enough to show, perhaps, to good advantage with the cattle fitted expressly for the show, while on foot; but giving them a good rub when placed on the block. The exhibit attracted much attention and favorable comment from the leading breeders of the country. I subjoin a few extracts from various sources: The editor of one of our leading farm journals says: "The more I reflect on your ten steers at Chicago the more I appreciate the importance to our feeders of your very interesting experiment as tending to do something that the Fat Stock Show seems never likely to accomplish, namely, to indicate the comparative merits of the various breeds for the profitable production of beef."

Another says: "The exhibit was the educational feature of the show. Here was the object lesson of animals of six breeds, fed under same conditions from calfhood, giving to visitors at a glance the differences in form, size, weight, finish and other characteristics."

The Country Gentleman calls it, "A specially noteworthy show."

The Orange Judd Farmer says: "As a matter of study, and an encouragement to experiments in practical agriculture, it will well pay those attending the Stock Show to take a look at these animals."

The Illnois Board of Agriculture very courteously gave me a hearing, and after discussing the subject came to the conclusion that as we had only one animal of each of two breeds we should confine the slaughter to one of each breed. This decision was, I believe, a wise one. The Board also decided that I must select the animals to exhibit and for the slaughter test. I endeavored in each case to select the animal that I thought, everything considered, would make the best showing for the breed. It was thought by some Shorthorn breeders that the steer Holt would have made the better carcass. He might have done so, but the carcass of Homer compared very favorably with that of the sweepstakes steer of that class, and I do not think there is much ground for criticism. Homer was over-ripe. I think Holt was also. They would have given better carcasses six months younger.

I wish to express my cordial appreciation of the courtesies extended by President Dysart, Secretary Mills, Supts. Funk and Moore of the cattle

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exhibit, and Mr. Hostetter, in charge of the books of that department. To these gentlemen we had occasion to refer frequently, and to their kind attention we are greatly indebted.

At my suggestion the Board of Agriculture decided upon the appointment of a committee to pass upon the merits of the steers as beef producers, market demand and price being taken into the account. We were especially fortunate in having a committee whose intelligence, experience, and fairness greatly emphasized the value of their decision. Mr. Stocking is an old time feeder from Central Illinois, and, like Mr. Imboden, has almost a national reputation, gained by their very efficient services as judges at former fat stock shows, while Mr. Ingwersen brought the experience of many years in buying in the greatest cattle market of the world.

The steers were shown November 19, and the following report made of their comparative merits by the committee.

To the Illinois State Board of Agriculture:

Your committee appointed to examine the steers of different breeds, fed by the Farm Department of the Michigan Agricultural College, to determine their value as far as profit to the feeder, their market value, and a profitable carcass from the butcher's and consumer's standpoint, submit the following report:

The Shorthorn steer, Homer, we rank first in the lot so far as profit from the feeder's standpoint is concerned. He weighing 1,870 lbs. at 1,071 days old, a gain of 1.74 lbs. per day. Homer also ranks first in value for the market as well as the block. On most markets he would outsell any of the others.

The Hereford steer, Hendricks, as a butchers' bullock is equal to the Shorthorn. He has not made growth enough for age, weighing 1,450 lbs. at 1,100 days, a daily gain of 1.32 lbs., to make a profitable beast for the breeder. On account of the lack of weight he would not bring quite so much as the Shorthorn in the market.

The Devon steer, Latitude, we should place third as a butchers' bullock and a seller in the market. While he is a well fleshed and even steer, he has not made growth enough to be profitable to the feeder, weighing 1,270 lbs. at 953 days, a gain per day of 1.33 lbs.

The Galloway steer, King Jumbo, on account of his rapid growth, weighing 1,620 lbs. at 987 days, a daily gain of 1.64 lbs., should be ranked second as a profitable beast for the breeder. While he lacks somewhat the finish and quality of the Devon, on account of his greater weight he would rank with him in market value. As a butchers' bullock we should rank him fourth, his finish not being quite equal to the Devon.

The Holstein steer, Nicholas, has also made rapid growth, weighing 1,660 lbs. at 976 days old, a growth of 1.70 lbs. per day, which would class him with the Galloway, from the standpoint of giving good returns to the feeder. He, however, lacks the quality which makes the best type of a butchers' bullock. He is too coarse, in the opinion of your committee, to make a profitable bullock, for the reason that, when finished and placed on the present markets, he would have to sell at a reduced price, from $1.00 to $1.50 per hundred less than the Shorthorn or Hereford.

The Jersey steer, Roscoe, while an excellent specimen of the breed, should rank lowest as a feeder, weighing only 1,420 lbs. at 1,161 days old, a daily gain of 1.28 lbs. In the present markets we think he would sell for the same

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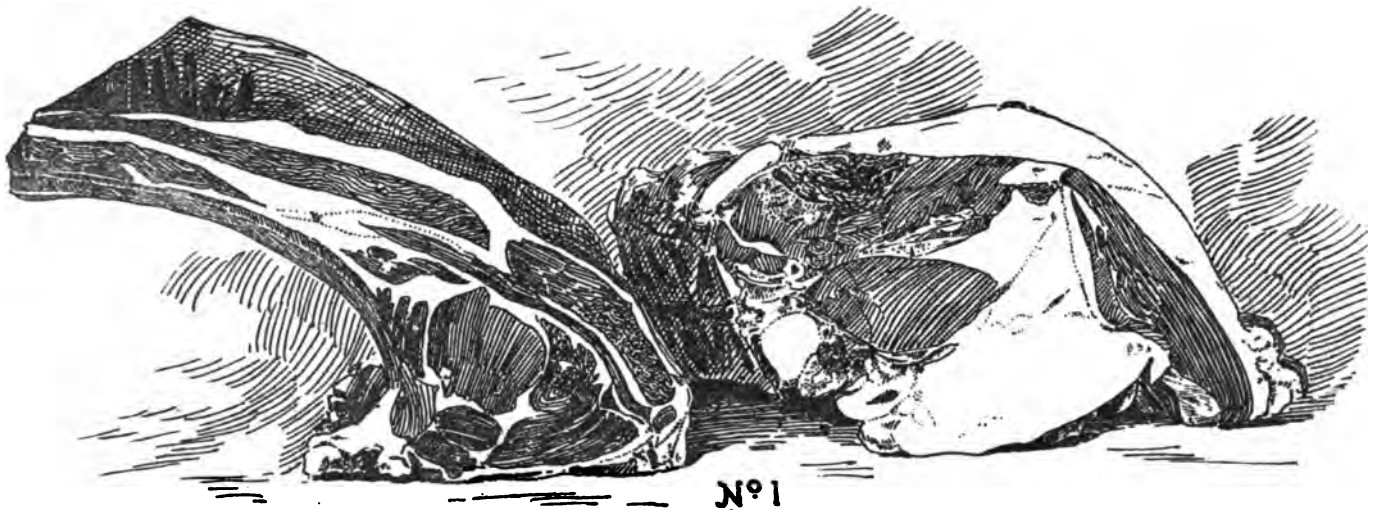

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DEVON.

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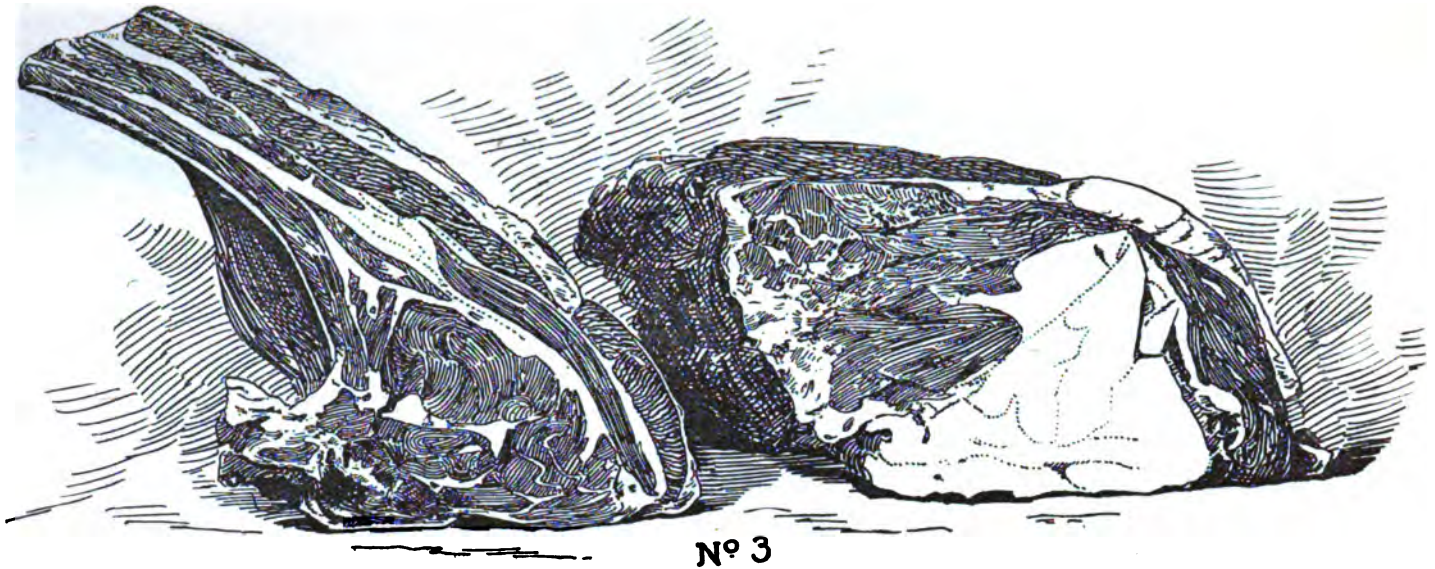

Nº 3

JERSEY.

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No 4.

GALLOWAY.

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No 5

SHORTHORN.

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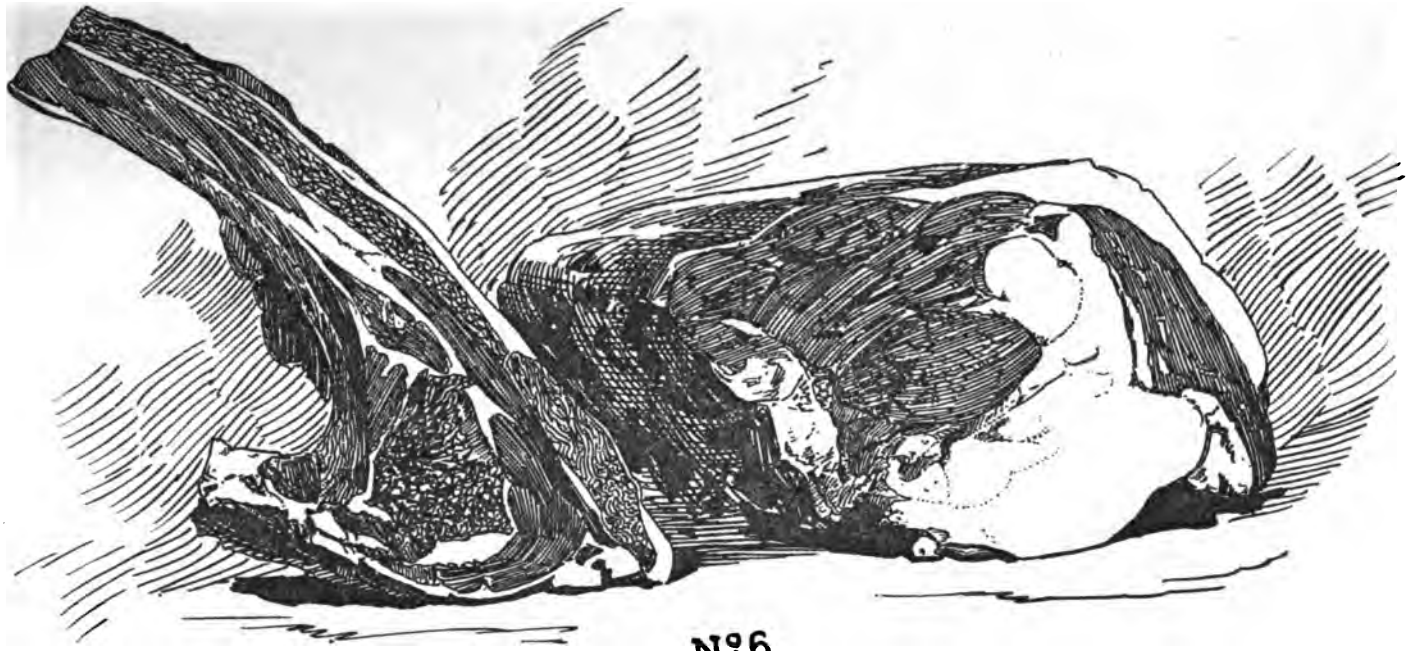

Nº6

HOLSTEIN.

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price as the Holstein, while, as a butchers' beast, on account of his finer bone and ripeness, he would be superior.

WM. STOCKING,
Feeder, Rochelle, Ill.

C. G. INGWERSEN,
Live Stock Commission Merchant, Union Stock Yards, Chicago, Ill.

J. G. IMBODEN,
Representing Imboden Bros., Butchers, Decatur, Ill.

On Tuesday, November 20, the following steers, being the same ones passed upon by the committee whose report precedes this, were slaughtered. The following table will give such facts as may be of interest in the comparison. After hanging 36 hours the carcasses were weighed and placed upon the tables for the final inspection. The following report was made on the dressed carcasses by the same committee that awarded the premiums in the dressed meat classes of the show:

To the Illinois State Board of Agriculture:

Your committee selected to report on the respective merits of the carcasses of six steers, each of a different breed, exhibited by the Michigan Agricultural College, respectfully report:

That as to quality and percentage of edible meat combined, making a profitable carcass for the butcher and consumer as well, we place first, the Hereford; second, the Devon; third, the Galloway; fourth, the Jersey; fifth, the Shorthorn; sixth, the Holstein.

RUDOLPH WEBER, *Chicago, Ill.*
MICHAEL OAKES, *Chicago, Ill.*
B. B. BONNER, *Chicago, Ill.*

NOTES ON CARCASSES.

There was but little difference between the carcasses of the Hereford and Devon. The meat in both was well marbled. The fat of a light color, laid on evenly but not to excess.

The Galloway had less fat. The meat was not quite so well marbled but was pronounced by all judges a carcass that would cut up very profitably.

The Jersey was especially characterized by the yellow color of the fat. The meat was excellently marbled with a sufficient amount of fat, so that it would cut up to good advantage.

The Shorthorn carcass had too much fat on the outside, and this not quite evenly distributed, but the cuts in the best parts were thick and finely marbled. On account of the excess of fat it was not thought as profitable a carcass for the butcher or consumer.

The Holstein carcass was less marbled than the others, and the meat was somewhat darker colored. The outside of the carcass was of a rather bluish cast, well covered with fat but not in excess. It must have given a good per cent of edible meat.

In speaking of the carcasses, The Breeders' Gazette says: "To the great surprise of some people the Jersey showed probably the finest grained carcass of the lot, the Devon, Hereford, and Shorthorn all presenting surpris-

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ingly rich cuts in the best parts, rivaling in fact the prize beef on the society's tables. It was a creditable showing in every way."

The Orange Judd Farmer says: "The most interesting part was when the judges passed upon the merits of the different breeds tested in the Michigan College experiments. A few comments caught by the way during the judging of these carcasses will aid very materially in forming an opinion upon the relative merits of this particular number. 'The Jersey will eat like a spring chicken,' 'no waste to it,' 'there's no piece of meat in the house that will out eat it,' 'the carcass drops away a little back of the shoulders and is a little coarse in the neck. (After tasting it). Just as I said it was.' 'The Shorthorn is very dear beef—over ripe.' They were surprised at the amount of fat. The Devon was considered the nicest meat for smaller butchers."

Very good photographs of the animals alive, and also of cuts of the fore and hind quarters of each of the dressed carcasses, were taken by Mr. John W. Hills, of Delaware, Ohio. These last give quite an accurate representation of the proportion of fat and lean, and the marbling of the same in the carcasses of the different breeds, and have been reproduced by the photo-lithograph process for insertion here as a definite illustration of the edible qualities of the meat of the different breeds.

The numbers on the cuts are used to refer to the different breeds as follows:

No. 1 represents the Devon, No. 2, the Hereford; No. 3, the Jersey; No. 4, the Galloway; No. 5, the Shorthorn, and No. 6, the Holstein.

Portions of each of the carcasses were sold to Hon. J. Irving Pearce, of the Sherman House, Chicago. I was very glad to place samples of the beef of each breed where its edible qualities would be as thoroughly tested as in this famous hostelry. Mr. Pearce's report will be read with interest in this connection.

Mr. Pearce says: "Taken as a whole the beef was very good. My head cook, who is an unusually intelligent and experienced handler of meats, says (and I have bought beef at every one of the Fat Stock Shows held here) that it was the best flavored and most profitable, from having the least waste meat, of any that I have ever bought at these shows.

"I found the Jerseys gave me a larger proportion of edible meat than any of the other carcasses, in fact there was no waste to it. No person tasted the meat without speaking of it. I was astonished at the amount of favorable comment it excited in regard to its tenderness and fine flavor. The poorest parts were better than ordinary choice cuts. The fats were good and profitable for use in cooking. Our pastry cook called it equal to butter.

"Next in order came the Galloway in quality and flavor and amount of edible meat; then the Hereford, the Holstein and the Devon in the order named; the Devon, in amount and flavor of the edible meat and quality of the fats, being equal to either of the other bullocks, except the Jersey, but lacking that tenderness found in the others. The Shorthorn was fine in flavor and tender as anyone could desire, but would be very unprofitable to the consumer. There was a very large waste in fats; much of what we call the corning pieces were so spongy and fat that we could not corn them or otherwise use them except to render them for fats which we could not use in cooking, and that is a product of little value to the consumer."

The following tables give the results of the three years' feeding in a summarized form, and in such connection, it is hoped, as will enable those inter-

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ested in the cost of production of the different breeds, the daily and yearly gains, the per cent of dressed to live weight, and other important facts in this connection, to get by comparison a clear idea of the lessons which they teach.

The grain fed the last year, like that of the two preceding, has been largely wheat bran, oats and some oil meal, and to this more corn meal was added, especially during the last six months.

The grain is estimated in these tables at $16.00 per ton, being a combination of bran at $12.00; oats at from $15.63 to $18.73 per ton, or from 25c to 30c per bushel; corn at from $14.28 to $16.07 per ton, or from 40c to 45c per bushel, and oil meal at $27.00 per ton. Hay was estimated at $8.00 per ton, roots at $3.00 and ensilage at $3.00.

TABLE I.—*From birth to one year old, amount and cost of milk not computed.*

Breed.	Name of Animal.	No. lbs. Grain.	No. lbs. Hay.	No. lbs. Roots.	No. lbs. Ensilage.	Cost of Food.	Weight at 1 year.	Gain per day.	Cost per lb.		
Devon	Latitude	1,020	1,225	39	207	$13 43	521	1.42	.025	Calved	Mar. 23, '86.
Hereford	Hendricks	652	619	.....	.....	7 65	705	1.93	.01	"	Oct. 27, '85.
Galloway	King Jumbo	1,126	1,459	.....	21	14 89	738	2.02	.02	"	Feb. 17, '86.
Galloway	Judge	1,104	1,361	.....	.....	14 27	829	2.27	.017	"	Jan 1, '86.
Jersey	Roscoe	1,041	847	.....	15	11 74	571	1.56	.02	"	Aug. 27, '85.
Jersey	Potter	1,467	938	.....	30	15 54	568	1.55	.027	"	Feb. 25, '86.
Holstein	Nicholas	1,288	1,430	.....	54	16 11	731	2.00	.022	"	Feb. 26, '86.
Holstein	Beltz	1,039	1,096	.....	.....	12 70	876	2.40	.014	"	Nov. 17, '85.
Shorthorn	Homer	1,068	946	.....	.....	12 34	801	2.19	.015	"	Nov. 25, '85.
Shorthorn	Holt	1,153	1,085	.....	.....	13 57	754	2.07	.017	"	Dec. 17, '85.

This table gives the amount of the food consumed, the cost of the same, the weight of the animals at one year, gain per day for one year, and cost per pound for one year.

It will be noticed that the milk consumed is not computed in the cost. Some of the calves were raised on the pail, some ran with their dams. The cost of the milk varies in different localities, and as the calves were brought from various parts of the State, it was thought best to leave the cost of the milk, which at best could only be estimated, for each feeder to determine for himself.

The Devon was brought up on the pail; after two weeks old he was fed on skim milk.

Hendricks, the Hereford, on the other hand, was suckled by his dam, and not weaned until about 8 months old. He received some grain, and all the hay he would eat during this time.

The Galloway, Jumbo, the two Holsteins, and the Jerseys were brought up on the pail. The other Galloway and the Shorthorns ran with their dams.

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A study of the table in regard to gains made may aid in answering the question, often asked, whether as good a calf can be raised on the pail as if allowed to run with the cow?

The Holstein, Beltz, made the greatest gain during the year, weighing 47 pounds more than the Galloway, King Jumbo, who comes next in weight; both were brought up on the pail.

The differences, in cost, of the so-called beef breeds and of those usually thought of value solely for the dairy, are much less than is generally estimated; the cost of the ten steers being quite uniform, with the exception of the Hereford, and, as has been stated, this was owing to his having been weaned later than any of the others, and so receiving more milk.

The cost per pound is quite uniform, one of the Jerseys having cost most, and one of the Holsteins least; excepting the Hereford, with one of the Shorthorns a close second.

It will be noticed that the animals of the same breed differ some in cost.

The greatest gain per day is by one of the Holsteins, while the Devon made the least. The individual gains of the same breeds are nearly uniform.

TABLE II.—*Cost and Gain for Second Year and Two Years.*

Breed.	Name of Animal.	No. lbs. Grain.	No. lbs. Hay.	No. lbs. Roots.	No. lbs. Ensilage.	Cost of Food.	Weight at 1 year.	Weight at 2 yrs.	Gain 2d year.	Gain per day 2d year.	Cost per lb. 2d year.	Gain for 2 years.	Gain per day 2 years.	Cost, 2 years.	Cost per lb., 2 years.
Devon	Latitude....	2,329	3,051	1,678	153	$33 57	521	1,009	488	1.33	.068	1,009	1.38	$47 00	.045
Hereford .	Hendricks .	2,273	3,090	228	390	31 46	705	1,105	405	1.10	.072	1,105	1.57	39 11	.035
Galloway..	KingJumbo	2,677	2,689	326	1,216	34 48	738	1,212	474	1.29	.072	1,212	1.66	49 37	.04
Galloway..	Judge.....	3,059	3,645	503	390	40 38	829	1,343	514	1.40	.078	1,343	1.85	54 65	.04
Jersey.....	Roscoe.....	2,638	2,870	199	330	33 39	571	1,007	436	1.19	.076	1,007	1.38	45 13	.044
Jersey.....	Potter.....	2,461	3,105	102	1,335	34 25	568	1,048	480	1.31	.071	1,048	1.43	49 79	.047
Holstein...	Nicholas...	2,989	3,594	226	1,382	40 71	731	1,316	585	1.60	.069	1,316	1.80	56 82	.043
Holstein...	Beltz.....	3,517	3,902	222	390	44 68	876	1,442	566	1.55	.078	1,442	1.97	57 38	.039
Shorthorn	Homer.....	3,157	3,741	226	390	41 25	801	1,367	566	1.55	.072	1,367	1.87	53 59	.039
Shorthorn	Holt.....	2,666	3,642	225	458	38 93	754	1,234	480	1.31	.081	1,234	1.69	52 50	.042

Table II carries the same items named in table I to the second year, and also gives some of the more important lessons for the two years.

Some questions as to the varying amounts of ensilage and roots consumed by the different animals may arise. The difference is accounted for, in large measure, by the differences in dates of birth, fall and winter calves not receiving any their first winter, while those born in the spring were so fed their first winter. The tastes of individual animals has also its effect.

It will be noticed that the cost of production is much greater this year. In all cases doubled and in some trebled.

In the cost per pound the first year, the greatest was 2.7 cents, while the lowest in the second year was 6.8 cents. The greatest is 8.1 cents.

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TABLE III.—*Third year. Experiments closed Nov. 1, 1888. All under three years except Hendricks* and Roscoe†.*

Breed.	Name of Animal.	No. lbs. Grain.	No. lbs. Hay.	No. lbs. Roots.	No. lbs. Ensilage.	Cost of Food.	Weight at 2 yrs.	Weight Nov. 1.	Gain for 3d year.	Gain per day 3d year.	Cost per lb. 3d year.	Gain 2d and 3d years.	Gain per day 2d and 3d years.	Cost for 3 years.	Cost per lb. for 3 years.	Gain for 3 years.	Gain per day for 3 years.
Devon	Latitude	1,969	1,113	533	.....	$21 00	1,009	1,270	261	1.19	.08	749	1.27	$68 00	.053	1,270	1.33
Hereford	Hendricks	2,922	2,898	.....	1,759	37 62	1,105	1,424	319	.87	.117	719	.98	76 73	.053	1,424	1.30
Galloway	King Jumbo	2,906	1,555	1,047	.....	31 04	1,212	1,620	408	1.60	.076	882	1.41	80 41	.049	1,620	1.64
Galloway	Judge	3,619	2,279	270	1,459	40 67	1,343	1,790	447	1.49	.09	961	1.43	95 32	.053	1,790	1.74
Jersey	Roscoe	3,114	3,401	717	1,255	41 48	1,007	1,383	376	1.08	.11	812	1.11	86 61	.062	1,383	1.26
Jersey	Potter	2,552	1,481	736	210	27 77	1,048	1,410	326	1.47	.076	842	1.37	77 56	.055	1,410	1.44
Holstein	Nicholas	3,023	1,663	735	196	32 22	1,316	1,660	344	1.40	.093	929	1.53	89 06	.053	1,660	1.70
Holstein	Beltz	4,223	3,434	267	1,701	49 47	1,442	1,870	428	1.23	.115	994	1.39	106 85	.057	1,870	1.73
Shorthorn	Homer	3,917	3,111	1,623	375	46 77	1,367	1,870	503	1.47	.105	1,069	1.51	100 36	.055	1,870	1.74
Shorthorn	Holt	3,556	2,649	1,633	224	41 84	1,234	1,670	436	1.38	.095	916	1.33	94 34	.056	1,670	1.59

* Hendricks to October 27.
† Roscoe to August 27.

TABLE IV.—*Hendricks and Roscoe, from three years old to Nov. 1, 1888.*

Breed.	Name of Animal.	No. lbs. Grain.	No. lbs. Hay.	No. lbs. Roots.	No. lbs. Ensilage.	Cost of Food.	Weight at 3 yrs.	Weight Nov. 1.	Gain.	Gain per Day.	Cost per lb.	Gain for Whole Time.	Gain per Day—Whole Time.	Cost for Whole Time.	Cost per lb.—Whole Time.
Hereford	Hendricks	117	53	.....	.....	$1 15	1,424	1,450	26	2.00	.044	1,450	1.32	$77 88	.053
Jersey	Roscoe	788	327	.....	.....	6 43	1,383	1,490	170	2.65	.037	1,490	1.28	96 04	.062

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In this connection the decreased gain per day should be noted. During the first year six of the ten, or the Galloways, Holsteins and Shorthorns, each made two or over two pounds gain per day, the Herefords and Jerseys over one and one-half pounds, and the Devon almost as much.

During the second year but three made a daily gain of 1½ pounds or more. The Hereford, 1.1 lbs., the least.

Taking the two years together the showing is better. It should be remembered in this connection that the steers were fed this second year for growth, as we had planned to finish them the third year. Had they been fitted for the market at 24 months the cost per pound would have been greatly reduced.

The same items named in table one are carried to the third year in this table, III., and some lessons for the entire time are also found here.

It must be remembered that the periods named in this table differ, from a year for the Hereford and Jersey, Roscoe, and a less time for the others, depending on the date of birth.

The variation in cost of food is, in part, caused by this.

In the gain per day only one animal, the Galloway, King Jumbo, has made over 1½ pounds per day; the other Galloway almost as much. The Jersey, Potter, and the Shorthorn, Homer, next, while the Hereford gained less than one pound a day.

The cost per pound is large for the third year.

Considering the whole time fed, it will be noted that the cost varies, but not more than the weights.

The cost per pound also varies. The least cost being King Jumbo, 4.9c, and the greatest, Roscoe, 6.2c. per pound. The cost of the others runs from 5.3c to 5.7c per pound.

The gain per day ranges from 1.28 pounds per day, that of Roscoe, to 1.74 pounds per day, that of Homer.

The important points of this table, IV., are already noted under III.

It contains the data concerning Roscoe and Hendricks from the time they were three years old to the close of the experiment, November 1, 1888.

Only a few days in case of Hendricks and over two months for Roscoe.

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TABLE V.—*Pounds net to gross weight. Weight of parts. Age in days, and gain per day from birth.*

Breed.	Name of Animal.	Live Weight at Slaughter—lbs.	Dressed Carcass after hanging 96 hrs. —lbs.	Net to Gross Weight.	Weight in Pounds.												Age in days Nov. 13, 1888.	Weight Nov. 13, 1888.	Gain per day from Birth.
				Pounds Net to Gross Weight.	Hide.	Tallow.	Blood.	Feet.	Head.	Tongue.	Liver.	Heart.	Lungs.	Paunch.	Guts.	Trimmings.			
Devon	Latitude	1,240	777	63	77	58	35	13	32	8	13	4	16	117	37	6	965	1,270	1.31
Hereford	Hendricks	1,430	927	65	85	60	33	15	30	8	12	4	14	131	35	6	1,112	1,445	1.30
Jersey	Roscoe	1,460	868	59	90	96	49	16	32	8	15	6	15	164	56	6	1,173	1,475	1.26
Galloway	King Jumbo	1,570	971	62	110	72	42	20	40	9	16	5	16	165	45	6	1,000	1,600	1.60
Shorthorn	Homer	1,810	1,210	67	100	84	52	20	38	10	15	6	18	155	43	5	1,083	1,825	1.68
Holstein	Nicholas	1,620	1,014	63	90	93	38	20	36	9	15	5	19	154	48	6	991	1,655	1.67
*Devon	Choice	1,745	1,142	65	97	82	46	19	38	9	16	6	18	142	44	11	1,377	1,750	1.27
*Hereford	Earl of Shadeland 14	1,880	1,279	68	120	70	38	18	39	9	15	7	13	177	46	8	1,052	1,980	1.83
*Hereford	Chance	1,440	917	63	98	43	48	23	35	10	12	5	15	155	32	8	963	1,470	1.55
*Shorthorn	Chief Brant	1,885	1,291	68	94	99	36	19	35	9	15	5	21	152	41	8	1,022	1,890	1.85
*Angus	Dot	1,495	1,040	69	86	73	31	17	25	8	11	5	17	110	34	8	863	1,515	1.75
*Sussex	Heasman	1,625	1,021	63	110	69	43	19	38	11	14	5	19	161	90	8	1,021	1,625	1.62

NOTE.—Those marked with a star (*) are prize steers of 1888, and are placed here for purposes of comparison.

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It is of importance to know how much merchantable beef can be obtained from the different breeds. This is shown in table V., also the weight of parts.

Some of the prize steers of the show of 1888, slaughtered the same day the experimental steers were, are placed in the same table for purposes of comparison.

As far as possible, animals of about the same age as the College lot were chosen, that the comparison might be fair.

It will be noticed that the showing is very creditable to the experimental steers, especially when it is remembered that they were not fattened purposely for the show, and that they were at the fairs four weeks in September and October, 1888.

TABLE VI.—*Shrinkage in carcass after hanging 36 hours, and weight of dressed quarters.*

Breed.	Name of Animal.	Live weight at slaughter.	Waste.	Weight of carcass.	Weight of carcass after hanging 36 hours.	Shrinkage.	Right hind quarter	Right fore quarter.	Left hind quarter.	Left fore quarter.
Devon	Latitude	1,240	416	824	777	47	185	200	188	204
Hereford	Hendricks	1,430	433	997	927	70	217	246	221	243
Jersey	Roscoe	1,460	553	907	868	39	208	228	205	232
Galloway	King Jumbo	1,570	546	1,024	971	53	226	253	226	266
Shorthorn	Homer	1,810	546	1,264	1,210	54	282	318	281	329
Holstein	Nicholas	1,620	533	1,087	1,014	73	251	251	257	255

Table VI. is interesting as showing the number of pounds each carcass shrank after hanging 36 hours, and the weight of the quarters.

CONCLUSIONS.

1st. The experiment seems to indicate that there is but little difference in the cost per pound of raising steers of the different breeds under the same conditions. The superiority of the beef breeds rather lies in their early maturing qualities, which enables the feeder to turn them off, well ripened, at two instead of three years.

2d. That calves brought up on the pail, when properly fed, will make as much growth and be equally as valuable for feeding as if they were allowed to suckle their dams.

3d. That there is likely to be a wide margin of difference between the judgments of the feeder, the butcher and the consumer, when they pass upon the bullock in the live classes, in the carcass competition as well as in the testing of the edible qualities of the meat.

4th. That prejudice resulting from a lack of information may be, too often is, the basis of our estimates of the comparative value of breeds.

5th. That early maturing breeds may be kept until over ripe, thus lessening the value of the carcass for the consumer.

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6th. The lesson is very emphatically taught that average native steers, weighing from 1,100 to 1,300 pounds at 3 years, or often much less, cannot be raised and fed with profit. Well bred steers weighing from 500 to 800 pounds more at the same age may be. The value of good blood for beef production cannot, then, be overestimated. It, only, can, with good care and skillful feeding, in these times and with the present markets, bridge the margin between loss and profit for the grower and feeder.

7th. That the quality of beef produced by a combined grain ration, in which wheat bran, oats and some oil meal form the principal part, is preferable to that produced by a corn ration exclusively. I believe these animals would have had a much less percentage of meat valuable to butcher and conumer if corn had entered largely into their grain ration.

8th. The lesson is plainly taught that early maturing breeds may be sold with most profit, perhaps, at one year, if pushed from the start.

The cost per pound of production is greatly increased with each succeeding year. Certainly under most favorable conditions they should reach the limit of profit at from 24 to 30 months at latest. This may be modified in ordinary feeding by the fact that the yearling steer will need more expensive food than older ones. The latter will consume more rough fodder profitably than the former.

9th. That the largest per cent of dressed to live weight does not always indicate the best quality of meat, nor the most profitable carcass for the dealer or consumer. So that the commonly received opinion, that the steer that shrinks least in killing is the best for the butcher, must be more or less modified by other conditions.

In concluding this final report the writer desires to express his sincere appreciation of the encouragement of the State Board of Agriculture, of the various cattle organizations and agricultural journals that have referred to our work, and to the State Legislatures which have appropriated moneys to carry on these experiments, the Hatch law only having been in operation a part of the last year.

While conscious that it was an untried field in experimental work, it seemed to me a very important one. Like all first essays in new fields, plan and execution of detail may not always have been the best. We can only say that we have aimed to do and have done in the most thoroughly conscientious manner, everything in connection with the experiment from beginning to finish. And it is no small satisfaction to feel and know, that however some breeders may have been disappointed in the results, no one has questioned in the remotest degree, so far as I know, the impartiality of the test. We offer this contribution to the cattle men and farmers of America, and hope there may be some lessons of real value for them in these reports.

One swallow doesn't make a summer, nor does one test prove the superiority of any breed.

It is only one (the first ever made) of a needed series of tests which shall enable us to give the average of results, and thus ultimately lead to something like a demonstration.

A prime lot of steer calves has been secured and are well started for a repetition of the test. We do not, at this writing, design to carry this second lot over 24 to 30 months, believing that profitable beef production means the securing of heaviest weight of merchantable beef at the earliest age possible.

Early maturity must be a prime factor in a profitable beef producer.

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Suggestions will be thankfully received from those who are interested in this work.

SAMUEL JOHNSON,
Professor of Agriculture.

MICHIGAN AGRICULTURAL COLLEGE,
January 18, 1889.

NO. 45.—DEPARTMENT OF BOTANY AND FORESTRY.

WHY NOT PLANT A GROVE?

These few pages on forestry have not been written to secure the applause of those who see little use for a bulletin unless it contain some new truths brought out by conducting careful experiments. On the contrary, they have been prepared with the view to help awaken an interest in the subject by calling attention to a few simple facts in the plainest way possible, and then to give some elementary hints on the selecting, planting and management of young forest trees in groves and screens.

For the past ten years or more the lumber cut in Michigan has been steadily on the increase, and during this time the great waste has been without a parallel in the history of nations. In the southern counties of the State, people are already beginning to be more careful about wasting the timber.

The average capacity of the saw mills in Michigan is nearly one-fifth that for the whole United States. About sixty per cent of all the yearly cut of white pine in North America is taken from Michigan. Still, she has left much hard wood of certain kinds, though that is fast going into market. After all, we must admit that a timber famine is yet a long way off, but it takes a long time to recuperate in case of a shortage in the timber supply. Of the three greatest interests of our country, manufacturing of all kinds ranks first, agriculture second, and forestry third.

"The evidence is ample and conclusive that we are making fearful inroads on our forest stores. We are cutting off a much larger crop than can possibly be replaced by natural growth within the period when, at the present rate, we shall have cleared the original forest off the ground. We are wasting our forests by the ax, by fire, by pasturage, by neglect. So far as timber is concerned, we are eating into our capital with little care for the future."—Dr. E. J. James in Forestry Bulletin No. 2 of U. S. Agrl. Dept.

Congress has appropriated large amounts of money for investigating and encouraging the growing of oysters, crabs, lobsters and fish, and the money already appears to be giving large returns. Our own State for some years

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has done a little by way of experiment to foster the production of fish in our lakes, ponds and streams. We legislate to protect birds and wild game, and appropriate money to encourage a large number of worthy objects, but for "our forests, from which we are drawing a larger amount in natural wealth than from any other source of supply, or from all other sources together, we have so far done practically nothing to protect or cultivate."—Dr. E. J. James.

If something profitable cannot be done in connection with this great subject of forestry, then it is very unlike any other question of great importance.

We feel confident that there are many important points in connection with forestry which should constantly receive a good deal of thought from many of our best citizens.

Although late in the day, in 1887, Michigan began to give a little attention to this important subject by placing five hundred dollars a year in the hands of the State Board of Agriculture for making inquiries and investigations. In addition to this amount, the State pays for printing the reports. None of the money is used to pay salaries of the commissioners or the directors, who have accomplished a little already in addition to their regular work in other directions.

The writer is now supposed to be passing one of the thousands of good farm houses situated in any of the older settled counties of the State, when the following conversation ensues:

B. "I see the snow drifts have not yet all disappeared."

C. "No, and we haven't had much snow this winter either, and there has been less strong wind than for some years past. Generally, of late years, when there is a heavy fall of snow, it is soon so unevenly distributed that we have little idea of how much has fallen. It piles up along the north and south roads, and blows from some parts of the east and west roads. The wheat field has many bare spots, while in other places the drifts are deep."

B. "What do you suppose has brought about this change?"

C. "Since I cut off that piece of timber down there and brought to view the farms over west for a couple of miles, the wind has frequently swept over my fields with a great deal of force, sometimes making things fairly jingle, and when cold the air seems to penetrate the smallest cracks in my pens, sheds and barns. The pigs squeal, the cows give less milk, the horses shiver, and even the hen-coop is too freely ventilated. I believe the animals at such times eat more grain and fodder than they do when there is less cold air in motion. The house, too, gets colder in the night than it used to when there were few strong winds. I am sure I have to lay in a larger supply of firewood than I used to."

B. "You seem to take in the whole situation at a glance."

C. "I have seen many changes in my life. When I came to this neighborhood, much of the land was still covered with a dense virgin forest. As one block of woods after another disappeared, I noticed the winds became more frequent and penetrating, but what could I do? and what could my neighbors do? We needed the land to raise more wheat and to feed more stock, and we got something for the timber which helped to pay off mortgages."

B. "There is a partial remedy for checking the fierce winds which drift the snows in winter, shake the apples from the trees in summer, and lodge the grain before it is ripe."

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C. "Yes, I know it. We can let the young trees grow up along the fences of our fields, and we can plant trees west of our farm buildings; but then it would be a great deal of trouble and cost a good deal to plant trees, and we should have to wait so long for any favorable results."

B. "The cost is much less than most persons imagine, and when once started, they keep growing year by year, and before you are aware of it, the little trees have grown upwards and spread outwards. Suppose you were to plow a strip a rod wide and ten or fifteen rods long either in a straight line, in a curve or in an irregular shape. That would not cost much. Then harrow it well, as though you were fitting the piece for corn."

C. "Then I should have to go to the woods and find some good trees, dig them, cart them to the house, dig deep holes, set the trees, stake them, mulch them, wait a while, see half of them die and the others would look pale and stunted."

B. "I think you could do better than that. Of course you must arrange the fences so as to keep cattle, sheep and horses away from young trees. Let us see about the plan for a wind-break or for a small grove. You can put in as many kind of trees as you like, the more the better, if you want to try experiments and think you would like to study them and learn their habits, but if you want trees that will grow fast, that are likely to remain healthy and furnish protection, you need only one, two or three species which are the best adapted for the purpose. We can't afford to go to the woods and dig trees. We can buy them cheaper."

C. "Buy them! Why, a nurseryman will charge me twenty-five to fifty cents apiece for his evergreens. I can't afford that."

B. "Procure small trees; they will cost much less; they can be more easily planted; will be more likely to live, and after a few years they will very likely catch up and overtake trees which were larger at the time of planting. The foundation of your screen will consist of evergreens. If others are added which are not evergreens, they should not be put in blocks each sort by itself, but mixed more or less in checker-board style with the evergreens. And the evergreens may as well be mixed if no others are planted. You will want to set them in rows, straight, curved or crooked in one way four feet apart and three or four feet apart in the row, so they can be as easily cultivated one way as corn or potatoes. There is little risk in setting too thickly, and the trees will sooner shade the ground.

"R. Douglas & Sons, Waukegan, Illinois, will send by mail:

"White pines, 3 years old, @ $1.00 per 100, or $8 per 1,000.

"Norway spruces, 3 years old, @ 75 cents per 100, or $6 per 1,000.

"At about the same price you can procure any or all of the following: European larch, white ash, American elm, black cherry, black locust and many others, remembering that for good screens, half or more of the trees should be evergreens rather equally distributed over the ground. W. W. Johnson, Snowflake, Antrim Co., Michigan, will doubtless send young trees at the above prices. A single row or two rows will make a good screen, but you will be better pleased with a wider strip of trees."

C. "I will send a postal card right away and get the price lists from these two men. It won't cost much to start a screen in that way. Tell me more about setting the trees, as you seem to know concerning such things."

B. "The trees arrive about the time you are sowing oats. Open the packages, and place the roots in damp soil in the shade, not forgetting that the

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roots of trees are unfitted by nature to stand the air. In the wind or the sun or in dry air, or in the open air roots will live just about as long as a black bass will live out of water; not much longer. Prepare some thin mud in a pail, filling it a third full. In this mud place the roots of the trees, one sort at a time. Of course you have staked or marked out your ground. Dig a small hole with a spade and let the boy drop a tree in the hole; straighten it up; replace the soil, not omitting to step your full weight with one foot each side and near each tree before leaving it. This is important, as it packs the soil close to the roots, helping it to retain moisture, and preventing the air from entering. One after the other, all the kinds are planted."

C. "Then what?"

B. "If you are now careless and lose all your interest in the subject, and keep busy at something else, you will very likely leave the young things to look out for themselves. The grass and weeds will choke them, and your little enterprise will cause deep regret every time you think of it, and prove the laughing stock of all your neighbors."

C. "I am not that kind of a farmer to drop a thing before I give it a fair trial."

B. "Then you will cutivate this land as you do your best cornfield, with level culture, only continue to cultivate all summer."

C. "What shall I do next?"

B. "Keep on cultivating during succeeding years, as long as a horse can get through the rows, perhaps four or five years or more, then the trees will not need it any longer. From time to time you will very likely pick up some other kinds of very small trees, or shrubs from the neighboring woods, and set them in among the others in the grove. If the cultivation is attended to, and the land is not too wet, you will be surprised at the rapid growth of the trees.

C. "Why can't I mulch the ground all over with straw from the old stack and save all further trouble?"

B. "It is not a good plan, and if you try it you will be disappointed. Cultivation is much better, and with the trees near the house, it is but a light chore to cultivate each time. If blackwalnuts, chestnuts, butternuts, hickories and oaks are desired in any places, plant the nuts where the trees are to remain."

C. "Thank you. I feel sure now that I understand the plan. It is so much cheaper and easier than I had supposed that I am going to plant a grove; even a small one started this year will be much better than a larger one long delayed and perhaps never planted.

B. "In older States like Massachusetts, farms already bring a better price if they contain some suitable groves or lots of young thrifty timber. As the grove improves with age, you will be reading every good thing you can get on forestry. You will take a deeper interest in the work of the State Forestry Commission. You will want to see their last report and all that may be issued in the future. You will have a good right to consider yourself as one of Michigan's most enterprising farmers. You will be planting for study as well as for producing a grove to shield animals or growing crops from the severe winds. You will be an experimenter, a pioneer in a good cause, and the longer you live the more you will see the importance of a knowledge of forestry.

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"What is the custom in this neighborhood in regard to pasturing woodlots?"

C. "Every one turns in his cattle, sheep, horses and hogs, or one or more kinds of these animals. It affords some feed, and cleans out lots of rubbish and makes the woods look like a park."

B. "Yes, and it lets in the light, and with the light grasses will slowly creep in affording more pasture, to be sure, but this will check the growth of larger trees, and small trees are not allowed to follow on to take their places. The man who has much interest in the future of his reserve timber lot will not use it for a pasture."

Reader, if not already done, will you not plant a grove this year, or do something to induce some of your friends to plant one? The writer will be glad to give any further instructions in his power on this subject, and would consider it a favor to receive a postal card from any who contemplates a grove.

DR. W. J. BEAL,
Prof. of Botany and Forestry,
and one of the Directors of the State Forestry Commission.

March 20, 1889.

NO. 46.—FARM DEPARTMENT.

POTATOES, ROOTS, FERTILIZERS AND OATS.

POTATOES.

The soil on which the potatoes were grown was a sandy loam, which had been seeded five years and used for a meadow.

The sod was heavy, containing June grass and Timothy with little clover.

The plats received a good dressing of barn-yard manure before plowing. The land was plowed seven inches deep, thoroughly harrowed with a spring-tooth harrow, and marked with furrows four inches deep and three feet apart each way, making 4,840 hills to the acre. This method of marking both ways is necessary to insure the same number of hills in each plat without the tedious method of counting each hill. No doubt larger yields might be secured if planted in drills.

The potatoes were cut in pieces, having from three to four eyes each, and one piece placed in each hill. The seed was covered with about four inches of earth, and then the whole field was rolled with a two-horse roller. This firms the earth around the seed, and unless the ground is very heavy, will

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aid in starting the seed to grow. If the ground is sticky and wet, a crust will be formed by rolling, which is not desirable.

The plants came up very uniformly. In rows containing 100 hills there would be no perceptible difference in the time of the appearance of the sprouts above the ground. This is important, for if there is a hill a little later than its neighbors, the potato beetle is sure to attack it in preference to the more vigorous plants.

The "Iron Age" five-tooth cultivator was used to tend the potatoes until the vines became too large to allow it to pass between the rows, when the double shovel cultivator was substituted, passing once in a row. We aim to give level cultivation so far as possible. Some raise the objection that the potatoes will sun-burn if not hilled up; but the balance of evidence is just the reverse, and the potatoes will not suffer from drought as badly when the ground is kept level. Plant deep and keep the ground level.

The potato beetles were as numerous as ever; but they are no longer a terror to potato growers, however great a nuisance they may be. We used "Hermes' Sprinkler" in applying Paris green, and were much pleased with it. It is carried on the back, contains three or four pails of water, and will sprinkle two rows at the same time.

In Table 1 we give the yield of eighteen varieties grown in 1887, for the sake of comparing with the results of the past year. The yield was very much less in 1887, owing to the severe drought which prevailed during the entire season. In the column showing the per cent of small potatoes, it will be seen that there is quite a variation. Some of the varieties, such as Nos. 9, 10, 12, 13, 15, 17, were very uniform in size, and are among the standard sorts which have been grown on the College farm for several years. No. 17 gives the smallest per cent of small potatoes, also an aggregate yield nearly equal to that of the best. No. 9 has also proved itself a very good medium early sort. It is earlier than No. 17. No. 15 is another medium early variety which is among the most promising. Of the late varieties, Nos. 10 and 11 stand at the head. No. 12 has always given a good yield, but its quality is not equal to some others. Nos. 21 and 23 are very much alike in manner of growing and in shape of tuber. The quality of both was very poor, and they were badly affected with scab. No. 23 ripened earlier than any other variety. Nos. 13 and 27 resemble each other very much (are probably identical. No. 25 is a very handsome potato; but as only one small potato was planted we are unable to judge of its merits. No. 28 is a variety sent out by the Department of Agriculture with no name. From two potatoes we made forty hills which produced two distinct varieties of large tubers, one white and the other flesh color, the latter differing in shape from the former. It is possible that the two potatoes received represented two distinct varieties, but they did not indicate it.

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TABLE No. 1.—*Potatoes. Comparative yield of varieties.*

Name of Variety.	No. of plat.	Date of planting.	Date of harvesting.	Early, medium or late.	Size of plat.	Yield of plat. Bushels.	Per cent of small potatoes.	Yield per acre in 1887. Bushels.	Yield per acre in 1888. Bushels.
Beauty of Hebron	1	May 10	Sept. 5	E	1-8 acre.	18 1-3	8	134	146
Clark No. 1	2	"	" 6	"	1-13 "	11 1-3	7	109	147
Vick's Extra Early	3	"	" 21	"	1-8 "	16 1-7	19	69	129
Lee's Favorite	4	"	" 21	"	1-8 "	16 2-15	7	96	129
Polaris	5	"	" 22	"	1-20 "	6 5-6	11	80	136
Early Harvest	6	"	" 22	"	1-8 "	17	9	90	136
Early Telephone	7	"	" 24	"	1-8 "	17 1-2	12	85	140
Early Mayflower	8	"	" 24	"	1-8 "	17 1-4	10	98	138
Chicago Market	9	"	" 24	M	1-8 "	17 1-6	4	118	137
White Star	10	"	" 28	L	1-8 "	19	3	126	152
Dakota Red	11	"	" 28	"	1-8 "	17 4-5	8	129	142
Rural Blush	12	"	" 28	"	1-8 "	19 1-2	6	92	156
Burbank Seedling	13	"	" 28	"	1-8 "	17 3-5	4	55	141
Thorburn	14	"	" 28	M	1-8 "	17 3-5	11	129	141
Alexander's Prolific	15	"	Oct. 1	"	1-8 "	20 1-3	5	120	162
Mammoth Pearl	16	"	" 1	L	1-8 "	19 5-6	6	118	158
White Elephant	17	"	Sept. 28	M	1-8 "	19 9-10	3	112	159
Garfield	18	"	" 24	"	1-8 "	15 4-5	9	66	126
Early Maine	19	"	" 22	E	1-13 "	7 4-5	16	.....	96
Pearl of Savoy	20	"	" 23	"	1-13 "	10 7-10	15	.....	139
Ohio Junior	21	"	" 22	"	1-13 "	10 1-5	16	.....	132
Empire State	22	"	" 22	M	1-13 "	9 9-10	9	.....	128
Early Ohio	23	"	" 6	E	1-13 "	7 13-15	13	.....	102
Watson's Seedling	24	May 11	Oct. 1	M	1-20 "	8	6	.....	160
Rural New Yorker, No. 2	25	"	Sept. 28	"	10 hills.	1-4	.....	.....	137
Wall's Orange	26	"	" 28	L	48 "	1 9-10	.....	.....	193
Rochester Favorite	27	"	" 28	"	48 "	1 1-2	.....	.....	150
Nameless	28	"	" 28	"	40 "	1 1-3	.....	.....	161

Table No. 2 shows the results with different amounts of seed. The yield of the plats for four successive years is given, together with the average total yield and the average per cent of small potatoes during the same period.

While there is a larger average yield from the whole potato, there is a much larger per cent of small potatoes. The next largest per cent of small

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potatoes is found in the one eye plat, and the smallest in the yield of the three eye plat. So far the results go to strengthen what we have always claimed, that a medium amount of seed is better than a whole potato or a potato cut to single eyes. The whole potato produces too much growth above ground, and the one eye does not give quite vigor enough, especially if the weather is unfavorable. There was a marked gradation in vigor of growth from the one eye up to the whole potato. Where one eye was planted the potatoes came up very unevenly and some of them failed to grow, proving that it is unwise to take the chances of securing a good crop from such planting. Unless the soil contains a considerable amount of moisture the pieces will become dry before they can send out roots and thus fail to grow. In 1887 nine per cent of the seed cut to one eye failed to grow. The beetle injured the one eye plat more than the others, from the fact that the plants were not so vigorous.

TABLE NO. 2.—*Potatoes. Yield from seed cut various sizes.*

Amount of seed in each hill.	No. of plat.	Date of planting in 1888.	Date of harvesting in 1888.	Pounds.					Average per cent of small potatoes for 4 years.
				Yield in 1885.	Yield in 1886.	Yield in 1887.	Yield in 1888.	Average yield for 4 years.	
From one eye	1	May 5	Sept. 29	104	144	50	162	115	20
From two eyes	2	"	"	144	253	71	172	160	16
From three eyes	3	"	"	186	197	86	212	170 1-4	13
From one-half potato	4	"	"	182	227	90 1-2	168	166 4-5	13
From one whole potato	5	"	"	188	198	117 1-4	232	183 1-2	24

In the experiment with different kinds of fertilizers—table 3—the potatoes were cut to three eyes and planted with the Aspinwall potato planter. The machine has a fertilizer attachment which works very nicely. The planter is arranged so that the seed is dropped in a furrow made by the machine and the fertilizer is distributed very evenly over the row after some dirt has fallen over it; and then the machine covers the whole with more dirt, leaving the seed in the soil at the depth of about four inches. The depth of planting can be regulated by the operator. Not knowing just how much seed the planter required, we failed to have enough of the Beauty of Hebron and were compelled to take another variety to test the salt and plaster. Unleached ashes and Mapes' Potato Fertilizer were applied at the rate of 400 lbs. per acre; salt, 300 lbs.; plaster, 200 lbs.; 400 lbs. mixture made up as follows: Salt, 150 lbs.; plaster, 100 lbs.; ashes, 150 lbs. In the case of rows Nos. 2 and 3 there was no difference in the yield.

The potato fertilizer seems to stimulate the growth of vines somewhat, but further than that there was no perceptible difference. The ashes alone did not give as good results as we might expect, but it is possibly due to their being too strong to apply to the hills in this way. Where the Thorburn variety was planted plaster gave much better results than the salt, which was a positive injury. Probably salt would have given better results had it been

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sown broadcast and thoroughly worked into the soil. It would not have injured the vines at least. The increase over the yield where no fertilizer was applied would hardly warrant the purchase of commercial fertilizers, other conditions being favorable.

Table No. 4 gives the results where potatoes were planted in furrows by hand. In plat No. 1 the potatoes were cut to three eyes and one piece placed in each hill. The seed was covered with about two inches of dirt, and Mapes' Potato Fertilizer was applied on the hills at the rate of 400 lbs. per acre. The hills were then covered with two inches more of dirt, making about four inches of earth over the seed. In plat No. 3 the potatoes were cut the same as in the first plat, and seed rolled in plaster, taking up all that would adhere. In plat No. 2 the same conditions prevailed, except there was no fertilizer.

In the notes taken during the season, frequent mention was made of the increased vigor of growth where plaster and potato fertilizer were used. In the yield there is a slight increase in favor of the potato fertilizer, but not enough to warrant the extra expense incurred in its purchase and application. Such an experiment must be continued for a series of years to obtain reliable data.

The yield of the potato crop was not large, owing to severe dry weather before the potatoes had matured. The growth during the fore part of the season was remarkable, but later, by lack of rain, the yield was materially lessened. In quality the tubers were very good and entirely free from rot. Some of the varieties were affected with scab, but not so badly as in some former years. It attacked the potatoes worse where the ground was richest and inclined to be heavy. The potatoes in the more tenacious soils and in the low places were most affected.

TABLE NO. 3.—*Potatoes. Effect of fertilizers.*

Variety.	No. of plat.	Date of planting.	Date of harvesting.	Size of plat.	Yield of plat. Pounds.	Yield per acre. Bushels.	Kind of Fertilizer.
Beauty of Hebron	1	May 11	Oct. 2	1 row	196	130	Ashes, unleached.
"	2	"	"	"	250	166	Mapes' potato fertilizer.
"	3	"	"	"	250	166	Mixture { Salt. Plaster, Ashes.
"	4	"	"	"	210	140	No fertilizer.
Thorburn	1	"	"	"	390	260	Plaster.
"	2	"	"	"	110	73	Salt.
"	3	"	"	"	360	240	No fertilizer.

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TABLE NO. 4.—*Potatoes. Effect of fertilizers.*

Variety.	No. of plat.	Date of planting.	Date of harvesting.	Size of plat.	Yield of plat. Pounds	Yield per acre. Bushels.	Kind of Fertilizer.
Burbank seedling.....	1	May 5	Oct. 3	125 hills	230	153	Mapes' potato fertilizer.
"	2	"	"	"	190	126	No fertilizer.
"	3	"	"	"	200	183	Plaster.

The following table is compiled exclusively from American analyses. In the first column is stated the total number of analyses from which the average was obtained. The probable accuracy of the average increases with the number of analyses on which it is based.

As it is desirable to know within what limits the composition of the roots is likely to vary, the maximum and minimum amounts of each ingredient have also been inserted in the table.

It is placed here because of its value for reference in the study of the root crops especially.

[From Composition of American Feeding Stuffs, by Dr. E. H. Jenkins of the Connecticut Experiment Station—Report of 1887.]

Composition of Roots, Tubers, other Vegetables and Fruits.

Name.	Analyses.	Total Dry Matter.			Albuminoids or Protein.			Crude Fat.			Nitrogen-Free Extract.			Fiber.			Ash
		Min.	Max.	Av.	Min	Max	Av.	Min	Max	Av.	Min.	Max.	Av.	Min	Max	Av.	
Beets, red.....	2	10.5	12.3	11.43	1.5	1.7	1.60	.2	.2	.18	7.2	7.6	7.40	.6	1.7	.12	1.08
Beets, sugar.....	8	9.2	16.4	13.03	1.7	2.9	2.01	.1	.2	.10	5.7	12.0	9.15	.7	1.1	.87	.90
Mangolds.....	6	5.6	11.7	8.68	1.0	1.9	1.52	....	.5	.16	2.4	8.4	5.00	.8	1.0	.84	1.16
Rutabagas	1	.....	.....	12.92	....	....	1.15	....	....	.09	.....	.....	9.11	....	....	1.16	1.41
Turnips.....	2	7.6	8.2	7.92	.8	1.3	1.02	.1	.2	.18	5.8	4.2	5.38	.8	1.2	1.01	.68
Carrots.....	6	8.9	13.5	11.70	.9	2.0	1.16	.2	.7	.42	5.1	10.4	7.68	1.0	2.3	1.38	1.06
Potatoes.....	7	19.4	24.1	21.90	1.1	3.0	2.19	....	.2	.10	15.3	20.0	18.19	.3	.9	.54	.88
Sweet potatoes....	5	26.6	34.0	29.37	.5	3.6	1.55	.3	.6	.38	18.0	29.7	25.09	.6	2.5	1.36	.99
Cabbage.....	2	6.5	10.2	8.28	1.8	2.0	1.95	.2	.5	.33	2.0	3.5	2.75	1.4	3.0	2.21	1.04
Squash	2	4.8	5.4	5.12	.6	.6	.66	.2	.3	.28	2.9	3.5	3.24	.5	.5	.54	.40
Pumpkin.....	1	...	.....	7.73	....	....	1.11	....	....	.16	.....	.....	4.34	....	....	1.49	.63
Apples.....	5	15 9	22.7	18.22	.2	1.2	.69	.3	.6	.41	12.6	20.0	15.31	.9	2.9	1.49	.32

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CARROTS.

In the experiments with the different varieties of roots we have aimed to secure a few new sorts and grow them alongside those which have proved to be of real merit here. The Long Orange carrot has been our standard variety grown for stock for several years. The White Belgian, Danvers and Short Horn were grown last year, with results as shown in the table. The White Belgian gave a larger yield than the Long Orange, but does not seem to have the substance of the latter. The opinion is based on the appearance of the roots and not on the results of an analysis. Both are good keepers. The Danvers and Short Horn do not yield heavy enough to grow for feeding purposes, although they are fine in quality and somewhat earlier than the first named varieties.

SUGAR BEETS.

Of the sugar beets there is not much difference in the appearance of the two sorts grown; but quite a difference in yield in favor of Lane's Improved. This sort has been grown on the college farm for several years. It is reliable and a good yielder. It is more easily harvested, from the fact that the tops do not grow so close to the ground. The crown is well above ground so that it can be pulled easily. Vilmorin's is said to contain the highest per cent of sugar of any known variety. Sugar beets are much relished by stock, and are good keepers. They do not harvest so easy as the mangels, from the fact that they carry more fine roots and thus hold the dirt more thoroughly. No doubt they are richer in nutritive qualities.

MANGELS.

Of the mangels, the Golden Tankard has been our standard variety for several years. It is of medium size, between the Globe and Mammoth Tankard in shape, and a rich yellow in color. It is a good keeper, yields well, and is of better quality than some of the larger roots. No. 1 is a Yellow Globe and of good quality. No. 2 is shaped like the Tankard, but is coarse and has not yielded so well as that sort this season.

RUTABAGAS.

Of the rutabagas, there is not much choice in the first three varieties. They are yellow in color and all good yielders. In quality they are good for the table or for stock. The White Russian gave a fine yield, but carries a mass of fine roots which hinder in harvesting, as the soil adheres to them so closely. Its keeping qualities might be impaired for this reason, especially when harvested in damp weather.

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TABLE 5.—*Roots. Yield.*

Name of Variety.	No. of plat.	Date of sowing.	Date of harvesting.	Size of plat.	Yield of plat. Bushels.	Yield per acre. Bushels.
Carrots:						
White Belgian	1	May 16	Oct. 24	2-25 acre	30.5	381
Danvers	2	"	"	2-25 "	20.9	260+
Short Horn	3	"	"	2-25 "	20.8	260
Long Orange	4	"	"	4-25 "	59.5	372
Sugar Beets:						
Vilmorin's	1	May 17	"	3-20 "	65.5	436
Lane's Improved	2	"	"	1-5 "	100.9	504
Mangels:						
Kniver's New Mangel	1	"	Oct. 25	3-20 "	76.6	510
New Red Fleshed	2	"	"	3-20 "	70 5	470
Golden Tankard	3	"	"	1-20 "	30.2	604
Rutabagas:						
Skirvings	1	June 19	Oct. 26	1-10 "	53.3	533
American	2	"	"	1-10 "	54.7	547
Yellow Swede	3	"	"	1-10 "	52.5	525
White Russian	4	"	"	1-20 "	25.8	516

In the experiment with different kinds of fertilizers the conditions were the same throughout. The fertilizers were applied on the rows, after the seed was sown, and raked into the soil.

The plat where the mixture of salt, plaster and ashes was applied, gives a slight increase in yield over the other fertilized plats, but not over the plat where no special fertilizer was used. The salt and mixture proved too strong for the young plants. They would no doubt have given better results had they been thoroughly worked into the soil before sowing the seed. The ashes alone gave better results than Mapes' Fertilizer.

The ground on which the roots were grown was a sandy loam. It received a heavy dressing of barn-yard manure, and was in good mellow condition. The seed was sown in drills three feet apart. Cultivation was with the "Iron Age" five-tooth cultivator and by hand hoeing. We thin the plants from eight to twelve inches apart in the row. While we do not think the average farmer, with dear labor, can afford to raise a large acreage of roots, we do hold to the opinion that a small area devoted to this crop will prove of great advantage in the feeding of stock.

Young animals are always more or less fastidious, requiring a frequent change in their rations to insure the best results. A few roots will prove beneficial. There is no stock that will not appreciate them.

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TABLE 6.—*Roots. Fertilizers.*

Name of Variety.	No. of plat.	Date of sowing.	Date of harvesting.	Size of plat.	Yield of plat. Bushels.	Yield per acre. Bushels.	Kind and amount of Fertilizer per acre.
Golden Tankard.....	1	May 17	Oct. 25	1-20 acre	27.3	546	400 lbs. salt.
"	2	"	"	"	26.8	536	400 lbs. Mapes' potato fertilizer.
"	3	"	"	"	29.6	592	300 lbs. mixture { Salt, Plaster, Ashes.
"	4	"	"	"	28.3	566	400 lbs. ashes.
"	5	"	"	"	24.2	484	200 lbs. plaster.
"	6	"	"	"	30.2	604	No fertilizer.

OATS.

In growing several varieties of oats only two were in plats large enough to warrant any computation of yield. The yield of those two varieties, Pringle's Progress and New Race Horse, fell a little below 38 bu. per acre, the former giving a slight increase over the latter.

All that was said last year in Bulletin No. 34, as regards the similarity of certain varieties, has been strengthened by the experiments of the past season. There are several varieties of the barley oat, such as Nos. 1, 2, 4, 5, 6, 15 and 16, that bear a very close resemblance. Nos. 1 and 4 grow a little coarser straw than the others, and do not ripen quite so evenly. The above are all very heavy varieties, weighing 36 to 42 lbs. per bushel, but they do not yield equal to our common white oat. The Welcome has been badly affected with smut for two years, while other varieties grown contiguous to it have not. It does not stand up as well as some of the others. Some of the varieties have not been grown long enough and on large enough area to enable us to form a definite opinion regarding them. The Welcome has been grown in the field for two years beside the common white oat, which is our best sort.

No. 3 was grown last year on a one-half acre plat and made a good growth of straw and size of head, but the yield was not enough to warrant any indorsement. It is an early oat; but the grain is not so plump and heavy as some of the barley oats. No. 7 is the earliest variety grown—was headed June 20th, 49 days from date of sowing. It is not a desirable variety from the fact that the straw is very fine and apt to lodge. No. 18 was grown last year for the first time and can not be readily distinguished from No. 15. Great yields are claimed for it; but, as in the case of most of the extraordinary yields, the conditions were extraordinarily favorable. Do not take for granted all that seed catalogues and enthusiasts say, but determine by thoroughly testing a few varieties which are adapted to the conditions of your locality. Grow the variety long enough and in large enough area so that there will be no sudden dropping off in the yield in passing from the plat to the field.

That many of the so-called new varieties have merit, and that the farmer can receive much good from changing seed occasionally there is no doubt; but go slow with the novelties, especially the marvelously yielding sorts.

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BARLEY.

Two varieties of barley were grown last season, the Manshury and the Chevalier. The former is a six-rowed variety with large heads, stiff straw and heavy grain. It is a little later than the common six-rowed barley or the Chevalier. The yield was 40 bushels per acre. The Chevalier is a two-rowed variety, said to have originated in Scotland. The straw is not so strong as that of the Manshury and the heads are not as well filled, although they are somewhat longer. It yielded 36 bushels per acre.

TABLE 7.—*Oats.*

Name of Variety.	No. of plat	Date of sowing.	Date of ripening.	Color of grain.	Remarks.
New Race Horse	1	May 2	July 25	White	Barley oat.
White Seizure	2	"	"	"	Barley oat.
Pringle's Progress	3	"	"	"	Straw strong, heads large.
Monarch New Zealand	4	"	"	"	Barley oat. Good length of straw.
White Victoria	5	"	"	"	Barley oat. Good length of straw.
Short Club	6	"	"	"	Barley oat. Short straw.
Harris	7	"	" 19	Dark	Narrow leaves and fine straw.
Millard's Kansas	8	"	" 27	"	Straw very short.
Waterloo	9	"	"	"	Straw very short.
Black Russian	10	"	"	Mixed	This oat has become nearly pure white.
Florida	11	"	"	Dark	Very grassy appearance.
Yellow Etherian	12	"	"	Yellowish	Straw fine and slender.
White Russian	13	"	" 30	White	Later than any other.
Norwez	14	"	" 27	Dark	Very poor oat.
Clydesdale	15	"	"	White	Barley oat.
Welcome	16	"	"	"	Barley oat, quite smutty.
Potato Oat	17	"	"	"	Barley oat, very heavy.
White Scottish	18	"	"	"	Barley oat, very heavy.

The experiments reported in this bulletin were in part planned by H. T. French, my assistant, and conducted largely under his supervision, He has also compiled, in good part, the details of the recorded work herewith presented.

SAM'L JOHNSON,
Prof. of Agriculture.

Agricultural College, Mich., March 16, 1889.

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NO. 47.—FARM DEPARTMENT.

SILOS AND ENSILAGE.

I. Seven years' experience with Silos and Ensilage at the College Farm.
II. Views of Prominent Farmers of Michigan on Ensilage.
III. Experiments with Ensilage vs. Corn harvested in the ordinary manner.
IV. Comparative test of varieties of Ensilage Corn.
V. Forage plants, Lucerne, Orchard grass.

Our experience with ensilage on the College farm dates from the year 1881, when the State legislature made a special appropriation of $1,000 "for the purpose of conducting experiments with ensilage for the feeding of animals, by the farm department of the Agricultural College." To Hon. J. S. Estabrook, of Saginaw, and Hon. Thos. Mars, of Berrien, chairmen of the House and Senate committees on the College, the credit is largely due of securing this appropriation, which made it possible for us to give this new method of preserving fodder crops some attention, especially at that stage in its history when it had very few advocates among agricultural teachers and writers, and when a majority of farmers were inclined to think it one of the most visionary and foolish suggestions ever made in the name of agricultural progress. A small silo was built in the basement of a grain barn then in process of erection, so that it might be utilized as a root cellar if the ensilage should prove a failure. So far as I am aware this was the first silo in Michigan.

Our experience with ensilage has been very satisfactory and our verdict of approval has been more and more confirmed with each succeeding year, as reference to our reports of the last eight years will show. Large silos have been erected and we now depend on ensilage for a good portion of our winter's food for our stock.

Seven years of experience have taught us some things about the silo and the questions that relate to it. But while there can be no doubt of the value of this method and of the fact that it is no longer an experiment, but conceded by all intelligent men to be a valuable adjunct to our methods of storing food for stock, there are still many unsettled or half-settled questions relating to it that demand attention. Nothing succeeds like success, and since the silo has come into favor, it has found many ready writers to urge its adoption.

I have endeavored to be temperate and conservative in my claims for the silo, and not to jump at my conclusions; for I fully believe that the half digested statements of many enthusiasts, without practical knowedge, have

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been as much of a hindrance to the introduction of the silo as the persistent opposition of some scientists, who have ignored practical results because they did not conform to their preconceived theories.

In the following pages I have aimed to give such suggestions about silos, the making and feeding of ensilage, as our experience has shown are calculated to give the best results.

Believing the testimony of practical farmers, in various parts of the State, who had silos would be of great value in this connection, I addressed a letter, with a schedule of questions, to several of them, with a request for replies based on their experience. A large amount of valuable information is embodied in their answers, published herewith, which, without exception, are decidedly favorable to this system.

SILOS—LOCATION, CONSTRUCTION AND MATERIAL.

As a matter of convenience and economy in handling the ensilage, the silo should be as near the feeding room or stable as possible, and on the same level. It may often be economically located in the bay of the barn, or in some adjacent building. The carting of the ensilage from the silo to other buildings is not only expensive, but there is more or less of waste from the exposure.

In the early history of silos it was thought that only stone, brick or concrete could be used in their construction, and that deep excavations or pits were preferable to having the structure largely above ground. More extended experience has demonstrated the fact that these more expensive materials are not necessary, but that silos built of lumber preserve the ensilage as well, if not better, and no difficulty is experienced in keeping the ensilage when the silo is entirely above ground.

I do not wish to be understood as objecting to the use of any of these materials. All of them have been used in the construction of silos and have proved satisfactory, so far as keeping the ensilage was concerned. Some have experienced trouble with the stone walls on account of their having proved conductors of the frost. We have never had much trouble in that particular, but the stone or brick silo is too expensive. The farmer is not apt to think of it as a permanent investment, and if he can build a silo with lumber, which is equally as good or better while it lasts, for less than half the expense of the stone or brick, he is quite likely to decide upon that material.

It will be remembered that the first silos in this country were excavations made in impervious soils. Mr. Francis Morris, of Maryland, made ensilage of corn in such excavations as early as 1876.

At the recent ensilage convention held in Cleveland a vote was taken on building silos; twelve voted for double boarding, with lath and plaster; three for double boarding, with tarred paper; and seven for only one thickness of matched narrow lumber on the inside of studding.

Great care should be taken to have the walls of the silo smooth and vertical, so that the ensilage shall settle evenly.

SIZE OF THE SILO.

To determine the size of the silo, estimate as a daily ration for each animal to be fed about 6 per cent of its live weight. This amount of good corn

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ensilage with a few pounds of wheat bran, oats, oil meal, or clover hay will keep animals in fine growing condition, and also will be found a good milk ration. Taking this estimate, to illustrate: Ten cows, weighing 1,000 pounds each, will consume 600 pounds of ensilage daily, or 18,000 pounds per month, or 108,000 pounds in six months.

We have found by actual weighing that a cubic foot of ensilage, two feet from the surface of the silo, under moderate pressure, weighs 36 pounds; eight feet below, 48 pounds; ten feet below, 50 pounds. It is safe to estimate about 40 pounds as the average weight of a cubic foot.

We must also make calculation for the settling, in our estimates. If well packed this will be found one-sixth to one-eighth of the depth of the ensilage; 108,000 pounds would require 2,700 cubic feet of space; add one-sixth for settling, and we have 3,150 cubic feet. A silo 22 feet deep, 10 feet wide and 14 feet long will give this capacity.

How can the same storage capacity be secured so cheaply as in this small silo? And when we add that this 54 tons of ensilage is sufficient, with a grain ration, to keep the 10 cows six months, and may be grown from three acres of good land, it opens up and emphasizes the possibilities of the silo as one of the main reliances of the stock man in these times of low prices.

It is better to build too large, than too small; have good height, avoid the deep silos or caverns from which the ensilage must be raised by machinery.

With a large silo I should prefer a partition, it is often more convenient in filling, especially if different crops are to be grown for this purpose. In feeding, so large a surface is not exposed, and consequently there is less liability of injury and waste.

Our first silo was built of stone in the basement floor of a barn; the new one, erected in 1887, of lumber and tarred paper. The following brief description will, it is hoped, give a clear idea of its plan and construction. The cost of a silo built in this way need not exceed from $1.50 to $2.50 per ton of its capacity. It is well to get as much depth as we can consistently, as the roof is the most expensive part of the building, and in feeding a less surface is exposed.

While we have always cut off a section of the contents near the door of the silo, as we began feeding the ensilage, for convenience (as one would cut out a section of a hay mow), and without loss, I am inclined to the opinion that it may be preferable to begin feeding from the top and take from the entire surface, if it can be done without too great an outlay of labor.

THE COLLEGE SILO.

The dimensions of the last silo built at the College are 18x30x22, with a partition in the center, making two silos each 15x18 outside measurement, and with a total capacity of nearly 200 tons. The silo is located on the north side of our cattle barn, which has a basement stable. We excavated some six feet to have the silo floor on the same level as the stable floor. The excavation is walled up to the surface with stone laid in ordinary mortar—a good 18 inch wall. Doors open from each silo into the feeding room, adjacent to the stable and on the same level. On this wall sills made of plank are bolted, and joists 2x12 and 16 feet long were used for studding and

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placed one foot apart. On the outside ordinary stock boards, battened and painted with two coats, made the finish. On the inside the studding was first covered with shipping culls, put on horizontally. On these a layer of tarred paper, then a second covering of boards was put on perpendicularly. This was lathed and plastered with water lime cement.

The floor is just as left when the excavation was finished. A good shingle roof, with a window and outside door in each silo—the latter for putting in and taking out the materials for weighting—completes the building.

The ensilage would have kept just as well without the cement coat. We put that on to preserve the boards; kept constantly wet, they will soon decay where the ensilage is placed next to them. As a hay barn this silo would hold twenty tons; but it has a capacity equivalent in feeding value to sixty-five tons of hay, estimating three tons of ensilage equal to one ton of good hay, which we have found in actual feeding a fair comparison.

The sides of the silo are well tied by strong iron rods that run from side to side. I lay much stress upon the use of 2x12 studding placed one foot apart. They not only add to the strength and lessen the danger from the lateral pressure, but also leave a twelve inch air space which affords more protection from the frost. The difference in the cost will not warrant the risk incurred by the use of light lumber in the construction of the silo.

CROPS FOR ENSILAGE.

It is claimed that any crop suitable for feeding in the green state will make good ensilage.

That a great variety of plants have been used with success for this purpose is well known.

Pease, oats, millet, rye, clover, sorghum, and many other forage plants have strong advocates of their merits for ensilage.

Indian corn is, however, the great ensilage crop of America. Clover is, by many good authorities, ranked second.

Corn is, perhaps, the surest of our forage crops, and, considering all the country, gives a greater yield than any other. The question is often asked, "What variety of corn is best for ensilage?" Some advocate the use of sweet corn; some a variety of ordinary field corn, and others the southern corn. Sweet corn does not seem to be as valuable for ensilage as the dent varieties. It yields less and there will be more acid in the ensilage, so that it is not usually as palatable. When the opinion prevailed that the leaf and stalk were the more desirable parts and the grain of little consequence, southern varieties were largely cultivated. The seed was much of it sown broadcast or very thickly in drills.

On both of these points there has been a change of opinion, one the natural outgrowth of the other.

It is now generally believed that the more mature the grain while the stalk remains green, the better the ensilage will be. So that early maturing varieties are now considered most valuable. A test of several varieties recommended for ensilage will be found in this bulletin. To obtain mature corn there must be more room for each plant, so thinner seeding is now practiced.

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WHEN AND HOW TO PLANT.

We sow with the Vandiver corn planter, in drills 3 feet 9 inches apart, using about 12 quarts of seed to the acre, and cultivate thoroughly during the growing season.

While very large yields per acre of ensilage corn are frequently reported, an experience of some years leads me to infer that these large yields are based on estimates, rather than on actual weighings. I am of the opinion that 20 tons to the acre is an exceptionally large yield. We have had some very good crops, but have never exceeded that weight per acre. From the 10th to the 20th of May is the best time for planting in this State.

WHEN TO CUT THE CORN.

For some years corn was put into the silo when very green. We now know that to make ensilage of greatest value, the corn should be more mature. The practice among those most successful with the silo, is to cut when the grain is beginning to glaze.

Prof. Goessmann, of the Massachusetts Experiment Station, who has given this subject much attention from a chemical standpoint, says, in the report for 1887: "It was found that the same variety of corn, raised under fairly corresponding circumstances, as far as the general character of the soil and the mode of cultivation are concerned, contained in one hundred weight parts, at the time of the first appearance of the tassel, from twelve to fifteen weight parts of dry vegetable matter, and from eighty-five to eighty-eight parts of water, while at the time of the beginning of the glazing of the kernels the former was noticed to vary from twenty-three to twenty-eight weight parts, and the water from seventy-seven to seventy-two."

Speaking of changes in plant composition, he says: "As long as the vital energy of an annual plant is still essentially spent in the increase of its size, as a rule but a comparatively small amount of valuable organic compounds, as starch, sugar, etc., accumulate within its cellular tissue. The comparative feeding value of the same kind of fodder plants, or any particular part of such plants, is not to be measured by its size but by the quantity of valuable organic constituents stored up in its cellular system."

He draws these conclusions: "The amount of vegetable matter in a given weight of green fodder corn, cut at the beginning of the glazing of the kernels, is known to be not only nearly twice as large, as compared with that contained in an equal weight of green fodder corn when just showing the tassel, but it is also known to be, pound for pound, more nutritious, for it contains more starch, more sugar, more of valuable nitrogenous matter, etc." We have put corn into the silo when the stalks were partially dry and sometimes after they had been frosted, and while we cannot doubt that there was some loss in nutrition, the ensilage was fairly good, and I am confident the corn so injured could in no other way have been as cheaply and economically stored for winter use.

The following tables are inserted here for reference, the first to show the difference in the nutritive value of ensilage made of corn cut at different stages of growth.

The analyses were made by Dr. C. A. Goessmann, Director of the Massachusetts Experiment Station.

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The second, by Dr. E. H. Jenkins, of the Connecticut Experiment Station, gives comparative values of ensilage and various other fodders:

Variety.	Source of Analysis.	Moisture.	Dry matter.	Analysis of Dry Matter, 100 Parts.					Per Cent of Digestibility.				Nutritive ratio.
				Crude ash.	Crude cellulose.	Crude fat.	Crude protein nitrogenous matter.	Non-nitrogenous extract matter.	Crude cellulose.	Crude fat.	Crude protein.	Non-nitrogenous extract matter.	
Corn ensilage	Board of Agriculture, '80	80.70	19.30	9.17	33.32	3.21	8.08	46.22	72	75	73	67	1:10.84
Ensilage of corn in tassel	*Report II	86.88	13.12	6.89	33.66	3.88	12.58	42.99	72	75	73	67	1:6.57
Ensilage of cut corn	Report III	81.88	18.12	5.07	26.23	3.49	7.83	57.38	72	75	73	67	1:11.8
Ensilage of whole corn	Report III	83.18	16.82	4.23	29.44	3.69	9.03	53.61	72	75	73	67	1:9.71
Corn ensilage	Report IV	77.48	22.52	4.19	19.08	3.49	7.82	65.42	72	75	73	67	1:11.3

*Reports referred to above are those of Mass. This table is taken from the Mass. Ag'l Report for 1887.

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Name.	Analyses.	Total Dry Matter.			Albuminoids or Protein.			Crude Fat.			Nitrogen-free Extract.			Fiber.			Ash.
		Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	
Green Fodder:																	
Maize fodder	75	7.1	48.5	21.26	.5	3.0	1.80	.1	.9	.45	3.2	22.1	12.94	1.9	11.4	4.99	1.08
Maize fodder, ensilaged	59	13.0	35.6	19.72	.7	2.8	1.52	.2	1.8	.70	5.1	22.2	10.49	3.0	10.0	5.70	1.31
Sorghum	7	13.6	28.4	21.66	.9	1.4	1.10	.2	.5	.31	5.8	27.0	13.08	4.7	8.5	6.25	.87
Sorghum, ensilaged	5	22.0	28.1	24.17	.6	.9	.75	.1	.4	.28	13.8	19.0	15.82	5.9	6.8	6.28	1.04
Rye fodder	6	21.9	25.3	24.72	2.3	3.0	2.61	.2	.7	.56	4.9	12.4	6.94	4.9	14.9	12.73	1.88
Rye fodder, ensilaged	1	.....	.....	19.25	.....	.....	2.42	.....	.....	.27	.....	.....	9.18	.....	.....	5.76	1.62
Oat fodder	2	21.4	28.8	25.10	1.5	2.0	1.77	.4	.7	.57	10.8	14.6	12.70	7.1	9.5	8.27	1.79
Clover	1	.....	.....	26.67	.....	.....	4.09	.....	.....	.69	.....	.....	11.61	.....	.....	8.12	2.16
Clover, ensilaged	3	21.5	27.4	23.73	3.0	3.8	3.34	.9	1.1	1.02	8.1	11.4	10.21	5.1	8.6	6.66	2.50
Lucerne or Alfalfa	6	18.0	28.5	22.83	3.6	4.9	4.09	.7	1.0	.83	7.9	11.8	9.60	4.9	8.7	6.26	2.05
Serradella	3	15.4	19.9	18.23	2.3	2.7	2.49	.4	.4	.41	6.4	7.0	6.80	4.0	7.7	6.42	2.11
Cow-pea vines, green and succulent	5	13.9	27.2	19.93	1.7	3.3	2.80	.2	.6	.43	5.3	12.9	9.27	2.9	15.3	6.31	1.62
Beet leaves	1	.....	.....	11.16	.....	.....	2.74	.....	.....	.60	.....	.....	2.49	.....	.....	2.50	2.83
Carrot leaves	1	.....	.....	16.70	.....	.....	4.26	.....	.....	.86	.....	.....	5.99	.....	.....	2.25	3.34
Cabbage ensilage	1	.....	.....	12.39	.....	.....	1.19	.....	.....	.93	.....	.....	4.52	.....	.....	1.59	4.16
Hay and dry coarse fodder:																	
Clover hay	33	78.2	93.9	88.62	8.9	20.8	12.55	1.5	4.3	2.44	35.0	49.0	40.55	15.6	35.7	26.85	6.23
Hay containing much clover	10	85.5	89.8	86.68	6.3	14.4	10.33	1.5	3.1	2.52	31.8	45.2	40.46	19.7	35.1	28.07	5.30
White clover hay	2	91.4	92.9	92.12	14.1	20.0	17.03	2.1	5.8	3.95	38.2	40.6	39.38	20.3	27.3	23.75	8.00
Alsike clover hay	5	91.4	94.7	92.38	11.4	16.1	13.53	1.6	4.2	2.41	36.5	43.5	40.91	24.0	29.5	27.68	7.85
Lucerne hay	4	91.6	94.3	93.05	10.2	18.6	15.33	1.4	2.4	1.89	35.4	47.3	39.66	26.2	33.0	29.20	6.97
Serradella hay	3	88.3	93.8	90.80	13.9	16.6	15.24	2.2	2.7	2.74	40.5	46.0	43.95	19.4	23.0	21.64	7.23
Timothy hay (*Phleum pratense*)	55	84.5	92.9	89.79	4.2	9.6	6.15	1.0	3.4	2.12	39.2	58.5	46.98	22.7	38.5	30.35	4.19

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Report of Conn. Experiment Station, 1888—Continued. Analyses by Dr. E. H. Jenkins Composition of American Feeding Stuffs.

Name.	Analyses.	Total Dry Matter.			Albuminoids or Protein.			Crude fat.			Nitrogen-free Extract.			Fiber.			Ash.
		Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	
Hay and dry coarse fodder—Continued:																	
Red top hay (*Agrostis vulgaris*)	2	90.2	93.2	91.68	7.3	7.8	7.50	1.5	2.0	1.70	46.5	46.9	46.72	27.5	31.8	29.62	6.14
Timothy and Red top	10	85.7	91.8	87.64	4.8	9.0	6.52	1.5	2.7	2.00	38.5	48.9	44.15	24.7	38.4	30.17	4.80
Orchard grass hay (*Dactylis glomerata*)	5	88.2	93.5	91.68	3.6	8.2	6.69	1.4	2.4	1.98	33.5	48.6	44.04	29.7	38.3	44.04	5.72
Hungarian grass hay	13	91.0	95.2	92.85	5.0	12.3	7.22	1.5	3.5	2.14	44.4	53.0	49.41	23.6	31.3	28.25	5.83
Barley hay (seed in milk)	1	.....	.....	89.75	.....	.....	9.21	.....	.....	2.47	.....	.....	47.49	.....	.....	26.14	4.44
Oat hay	3	86.3	91.3	89.32	7.8	9.9	8.53	2.1	3.1	2.52	36.2	48.0	41.93	25.1	33.6	29.92	6.42
High meadow hay	2	88.7	89.4	89.02	6.8	8.3	7.57	2.0	2.5	2.25	46.9	47.5	47.19	24.3	25.2	25.78	6.23
Hay from mixed meadow grasses	11	79.7	87.0	84.04	4 8	9.2	6.38	1.4	2.7	2.09	34.4	47.3	41.05	22.9	35.9	29.90	4.62
Low meadow hay	10	85.5	93.6	89.50	4.6	10.4	7.70	.7	3.6	2.20	39.8	55.2	43.60	21.4	40.0	30.20	5.80
Hay from salt marsh grasses	13	81.4	92.8	89.89	4.0	7.8	5.69	1.6	3.1	2.31	34.1	54.3	44.10	25 1	37.9	30 51	7.28
Baled hay "extra fine"	1	.....	.....	84.05	.....	.....	6.20	.....	.....	2.19	.....	.....	45.13	.....	.....	26.60	3.93
Maize fodder, field cured	7	60.6	77.1	69.40	3.8	6.8	5.14	.6	2.0	1.40	30.5	47.8	39.08	14.4	24.7	19.61	4.17
Maize stover, field cured	13	51.3	84.6	75.56	3.0	8.3	5.29	1.1	2.2	1.48	26.4	46.2	40.09	17.7	29.5	24.17	4.53
Buckwheat straw	3	89.6	91 0	90.09	3.3	7.8	5.15	.7	1.7	1.26	32.1	38.9	35.16	37.2	46.8	42.98	5.54
Oat straw	12	87.5	93.5	91.26	2.3	6.9	3.82	1.0	3.2	2.22	26.4	51.4	38.89	29.5	56.0	41.52	4.81
Rye straw	8	87.5	93.7	93 24	2.2	6.9	3.46	1.0	2.7	1.40	35.7	52.9	38 35	34.2	43.3	45.25	3.78
Wheat straw	6	82 1	93.5	91.22	2.9	5.0	3.45	.8	1.8	1.29	31.0	50.6	37.33	34.3	42.7	44.99	4.16
Cow-pea vines	6	86.0	90.7	85.95	13.6	19.8	15.68	1.1	4.1	2.87	34.9	43.4	42.17	17.2	23.7	19.80	8.41

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FILLING THE SILO.

Various methods of cutting corn and drawing it have been suggested. No one is probably always the best. Some use a reaper, cutting one row at a time. We have cut our corn by hand, and have found that by driving the wagon close along the row and cutting not more than two rows at a time, so as to avoid carrying any distance and having the men who are cutting place each armful directly on the wagon, never laying it on the ground to require a second handling, the most satisfactory.

The stalks, if proper care is taken in loading, are all laid straight and in the best possible shape for going to the feeder, which enables him to feed with more facility than would be possible with them tangled more or less, as they will unavoidably be when cut with a reaper or thrown in bundles on the ground.

Some have advocated cutting the corn and allowing it to wilt for a day or two before putting in the silo, but I do not think this practice is to be commended. It increases the labor, and if the corn is properly matured, the sooner it is placed in the silo after cutting the better.

Some writers lay great stress upon having the corn dry when it goes into the silo. That rain-water upon the corn injures it is denied by all experienced silo men. Some say that their best ensilage is that which went into the silo when quite wet. It is no unusual thing to have a load or two caught in a shower, and no one need fear any injury resulting from putting the corn in wet. If corn fodder was over ripe, so that the stalks were quite dry or had been frosted, I think the ensilage made from such fodder would be improved by wetting it quite thoroughly when put into the silo.

We use the Belle City feed cutter and carrier made at Racine, Wis.; our power is a ten-horse engine. The tread, circular and geared powers, sold for from $50 to $100, will be found satisfactory for cutting ensilage, and can also be utilized in much other work where power is demanded on the farm.

We have always kept a man in the silo (sometimes two or three when student help has been plenty) to keep the ensilage evenly leveled and packed solidly. I am aware that some writers seem to think this careful, solid packing unnecessary; but I am convinced, after years of experience, that when this has been attended to most carefully, everything else being equal, we have had the best ensilage. It is well to throw the cool ensilage from the corners and about the walls of silo into the center and replace it with that which is warmest, thus preserving an even temperature.

I should always advise cutting the corn. Some have practiced putting it in the silo without, but the long stalks do not pack as closely as when cut in half or three-quarter inch lengths, and there is more danger of injury to the ensilage, while it is much more troublesome to take the long stalks from the silo. I think it will be rare to find anyone who has practiced both methods, who will favor filling with the uncut stalks.

Clover may be placed in the silo without cutting.

SLOW OR RAPID FILLING.

During the first years of ensilage making, it was urged that the silo should be filled as rapidly as possible. More experience has led to a change of opinion on this point, and the theory has been advanced that if the silo was

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filled slowly and its contents allowed to heat up from 120° to 130° Fahrenheit, the bacteria or germs that cause fermentation would be destroyed and we should have what is termed sweet ensilage, it being claimed that the rapid filling tended to produce more acid, resulting in sour ensilage. This theory of producing sweet ensilage by slow filling has been quite generally accepted and practiced for two or three years past.

I am of the opinion, however, that positive evidence to sustain this theory is almost if not entirely wanting. Enough careful work has not been done to demonstrate it beyond question. A large number of careful and experienced men claim that rapid filling makes good enough ensilage, and is much more economical so far as labor is concerned.

At an institute in Pennsylvania last winter two specimens of ensilage were brought in for inspection. One sample was much sweeter and of better quality than the other. This sample, it was afterward learned, had been made in a silo filled rapidly, while the other was the result of slow filling and heating to the degree of temperature claimed to kill the bacteria. The corn was alike and the conditions the same so far as I could learn, except in this one particular of the slow and rapid filling.

May it not be that the reason for our having better ensilage in recent years is to be attributed to the fact that we have been putting in our corn when more nearly matured than formerly? Certainly there should be some careful experiments made to determine whether the theory is correct or not.

On this point Prof. H. E. Alvord, President of the Maryland Agricultural College, whose long experience and varied experiments with ensilage make him one of our best authorities, says: "From its first introduction the chief fault found with ensilage has been the acid character of the material at the time it is fed to animals. This acidity results from fermentation in the silo, caused by living organisms, known as bacteria. Enthusiastic friends of this process of preserving forage claimed, a few years ago, that they had discovered a method of making sweet ensilage.

"The theory upon which this method is based is that the bacteria of the ensilage fermentation are destroyed and the fermentation thus arrested by a certain degree of temperature, placed variously at 120° to 140° F. The little creatures are induced, as it were, by favorable conditions, to work themselves into such a state of excitement as to die of apoplexy from their own fervent heat. It is a very pretty theory, or was, as long as it lasted, but that was not long. As well try to fan a fire to such intensity that it would extinguish itself and without injury to the fuel. Careful students soon discovered that the bacteria of the silo were particularly happy and active at the very temperatures which it was claimed would destroy them. Temperatures 120° to 160° F. are most favorable to their development and activity, and it requires at least 185° to destroy them, while fermenting ensilage does not often exceed 140°, and no authentic record of 150° F. can be found. How men could so deceive themselves—and some of scientific reputation have been among them—it is hard to understand; but the evidence is conclusive that they were wrong. I have never yet been so fortunate as to see any ensilage which I could call 'sweet.' Of course, the material differs greatly in the degree of its apparent acidity, and as comparative terms, sour and sweet may be convenient as applied to ensilage, although deceptive. I see no evidence that any relation exists between the method of filling the silo—the slow process or the quick process—and the acidity of the product. On the whole, I prefer the straight

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ahead way, no undue haste, but pushing the job of harvesting and filling to completion without unnecessary delay. It is most economical of labor, especially if the task is a large one, and gives ensilage of full as good a quality. Yet, if circumstances make slower work desirable, or if an accidental detention occurs, there need be no fear of serious loss."

Prof. Henry, of Wisconsin says: "In regard to making the so-called sweet ensilage, the main point appears to be to have the corn well ripened, ready for early cutting and shocking. Corn ripened so that the grain begins to dent will make sweet ensilage, even if the silo is filled in a single day."

THE WEIGHTING OF THE ENSILAGE.

In the early history of the silo heavy weighting of the ensilage was used as an essential detail to secure a good product. More extended experience has modified our views on this point. Now many of our experienced silo men think that no weight is needed, and that covering with a foot of cut straw or hay is all that is necessary.

I have no doubt that a crust from six to twelve inches deep will be formed on the surface of the ensilage that will usually protect the product below without any weight or covering. The question is one of economy merely as to the saving of the ensilage. It would often be as expensive to draw and cut the straw or hay as it would be to put on a moderate weight if materials are at hand. The labor and expense of weighting I think has been overestimated by many writers on this point.

The extra outlay required to weight moderately is too trifling to warrant our taking the chance of a failure because of neglect in this particular.

FEEDING OF ENSILAGE.

In the fall of 1881 we filled our silo for the first time, and from that date to this, with the exception of a single year, we have fed ensilage more or less every winter. Every year's experience only confirms and strengthens our faith in its value as a most excellent and cheap part ration for stock, so that our verdict, after seven years of fair and practical trial, is decidedly in its favor. I would not know how to get our stock through the winter without ensilage. It is especially adapted to cattle and sheep, and is being fed extensively in some large horse breeding establishments. Mr. M. W. Dunham, of Du Page, Illinois, the noted Percheron importer and breeder, has, I learn, fed ensilage largely this season. Swine and poultry are also reported as eating it readily and with good results.

During the first excitement over ensilage it was claimed that it was a whole ration. It is now demonstrated that to secure the best results clover hay, oats, wheat bran, oil meal, or other nitrogenous foods should always be fed in connection with corn ensilage.

The same is true of dried corn fodder. The corn plant, green or dry, stalk or grain, is not a well balanced ration, having too large a per cent of carb-hydrates or fat formers.

It will always pay to combine to a limited extent more nitrogenous foods with our corn rations. The health and thrift of our animals will be secured and they will give more liberal returns at the pail or in meat production when fed in this manner.

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Ensilage is excellent food for dairy cows, producing milk of the best quality. The evidence of such men as Mr. Hiram Smith and Prof. Henry of Wisconsin, and Mr. E. A. Powell of Syracuse, New York, and a host of others, whose names might be mentioned, on the value of ensilage for milk production, ought to satisfy any reasonable man of its merits.

Good ensilage, if fed judiciously, will produce good milk, that will, I believe, prove satisfactory for any use.

Prof. Alvord found in a test made at Houghton farm, that a greater per cent of the fats of the milk were converted into butter when the cows were fed grain and corn ensilage than when fed hay and grain.

Prof. F. W. A. Woll, of the Wisconsin Experiment Station, found that 12.60 per cent more of the fat was churned out from the mixed milk of two cows when the cows were fed on ensilage than when they received corn fodder.

The story, started some years ago, that manufacturers of condensed milk would not buy the milk from cows that had been fed ensilage, has been repeated time and time again by the opponents of this method of preserving fodder as evidence of its lack of value. It is now stated, on good authority, that in this case the injury was caused by the polluted water which the cows were compelled to drink, and that the ensilage had nothing to do with it whatever.

The lie has gone many leagues, in this case, while truth was getting on her boots.

ENSILAGE A SUBSTITUTE FOR ROOTS.

As early as 1882, I took the position that ensilage would be a cheap substitute for roots, furnishing the succulent fodder so needful for our stock during the long period of winter feeding.

I go further today and affirm that good corn ensilage is, in my opinion, more than a substitute for roots. It has a much higher value. In confirmation of this statement I refer to our experience last winter. We grew some hundreds of bushels of roots, which were put in the root cellar the last of October. The cellar was nearly full, and, as the weather continued so mild, I feared there was some danger of their rotting. On account of this I directed the herdsman to defer opening the silo until the first of January and to commence feeding the roots, so that we might open up ways through the pile and secure more ventilation and so obviate the risk of decay.

Roots were fed until January first, when our silo was opened and we began to feed ensilage. It is of first quality this year, much of the corn was fairly well eared and cut in the roasting stage or a little past. I do not think a casual observer could have failed to notice how rapidly our cattle improved in flesh, in thrift, as evidenced by the hair and general appearance, when we fed the ensilage in place of the dry corn fodder and roots which they had received through December. I should say the grain ration was lighter with the ensilage than with the roots and dry fodder. This is only observation, it may be said; but reference to the reports of careful experiments made here in recent years and published in former bulletins, will prove by exact figures the correctness of this position.

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SILOS IN THE UNITED STATES.

The number of farmers in all sections of our country who are adopting this system is rapidly increasing. Statistics are not very accurate as to the number of silos, but it is estimated that in Wisconsin there are not less than 1,500, Massachusetts almost as many, Vermont between 200 and 300, New York quite a large number. I think in Michigan there cannot be less than between 100 and 200, and many of these were erected last season. Prof. Robertson, of Ontario, reports that a large number will be built in that province the coming season.

ENSILAGE IN ENGLAND.

The English Parliament appointed a committee to investigate and report upon this method of preserving fodder, as likely to be of great importance to agricultural interests. The committee, composed of some of the best known men in the kingdom, after taking a large amount of evidence from those who had built silos and fed ensilage, and after the most thorough examination of the subject, made a favorable report. They report that "all the evidence seems to show that a nourishing, useful food for animals can be preserved by this process." They further report "that the testimony of the dairy farmers *does not justify* the assertion that dairy products are injuriously affected by ensilage, but that on the contrary it distinctly improves the yield of milk and cream and the quality of the butter; the silos in Great Britain have doubled in number in the last twelve months; and that the evidence warrants the extension and development of the system as a valuable auxiliary to the farm."

In 1886, 1,605 silos were reported in England, in 1887, 2,694—nearly doubling in a single year. Exact figures are not at hand for 1888, but more silos have been built than in any previous year. Even in "Merry Old England," the birthplace and home of root culture for centuries, ensilage seems to be taking the place of roots as a stock food. As evidence of this fact I quote the following from a writer in a recent number of "The Agricultural Gazette," published in London:

"I find I can get about the same weight per acre tares ensilage as I used to grow of Swede turnips, and the latter required one acre of hay in addition to one acre of turnips to feed the same amount of stock as I can now feed off the one acre of tares alone—that is, one acre tares ensilage goes as far as one acre Swede turnips and one acre meadow grass hay put together. Therefore I think one of the great features of ensilage will prove to be that it will entirely supersede the growth of turnips. It is cheaper to grow than turnips, is as good and cheaper as a cleaning crop, and saves the one acre of hay in addition. On strong land, where roots cannot be grown, of course there is no question. The average turnip crop throughout the kingdom is, I believe, 12 to 13 tons per acre; the average of tares would be little, if any less; those with best turnip land may grow 20 tons per acre and more, but such land will also grow exceptional crops of tares—and it is palpable that though such land specially favorable for turnips may grow more of them than of tares, it will not be sufficiently greater to counterbalance the extra cost of cultivating of the whole of the requisite acre of hay."

The cost of the silo need not deter any one from adopting the plan. I am confident you cannot secure storage for an equivalent amount of forage in

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any way at so little expense as you can in the silo. It costs almost if not quite as much to cut an acre of dried corn fodder as an acre of green, save the one item of hauling—you have the expense of hauling, binding stalks and setting up in shocks. The corn must be cribbed, be hauled to mill, crushed to cob meal or shelled and ground, hauled home; all items that count and add materially to the cost of feed. When you put your corn in the silo the one operation finishes it, and all you have to do is to place it all prepared before your animals, who look their gratitude for such palatable rations. You will not be charged with want of sense or fanaticism if you build a silo.

I want to controvert the often expressed idea that the small farmer cannot afford the silo, I believe if the farmer with few acres looks at this question rightly, he will find the silo an essential adjunct to his farm dependencies quite as much, aye more, than the large land owner. The small farmer with limited area of land is necessitated to crop more continuously than his neighbor with a much larger acreage. He needs in every possible way to secure the fertilizing material that shall replace the drains that this closer cropping is making on his fields. How can he do it so cheaply, so surely, as by growing large crops of ensilage corn that will give him the main fodder necessary to enable him to feed for the market or the dairy through the winter much more stock than his acres will carry in the summer?

VIEWS OF PROMINENT FARMERS OF MICHIGAN ON ENSILAGE.

The following schedule of questions is the one referred to on a former page of this bulletin, and the replies from prominent farmers in different sections of the State will be read with interest and profit, especially by persons in their vicinity who contemplate building a silo:

QUESTIONS RELATIVE TO SILO AND ENSILAGE.

1. When did you build your silo?
2. How is it constructed?
3. What crops have you ensilaged?
4. What variety of corn have you found most satisfactory?
5. Do you plant in hills or drills?
6. How much seed to the acre do you use?
7. At what stage of growth do you cut?
8. What is the average yield per acre?
9. Is this yield estimated or weighed?
10. Have you ever put corn in the silo uncut?
11. Do you fill the silo rapidly or slowly, and why?
12. Do you pack the ensilage as closely as possible during the filling?
13. What do you use for covering?
14. Do you advise moderate weighting?
15. What does your ensilage cost per ton or per acre?
16. How many months after filling the silo was it opened?
17. What was the condition of the ensilage?
18. Did it change after opening, if so, how?
19. Do you feed ensilage alone, or in combination with dried fodder and grain?

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20. What is your opinion of ensilage for milk production?
21. In your opinion, is the quality of milk injuriously affected by feeding ensilage?
22. Have you had any experience in feeding ensilage to sheep, swine or horses?
23. In your opinion, can storage be secured in any other way, for an equivalent amount of fodder, so cheaply as in the silo?
24. With your experience, do you consider this method of preserving fodder economical and satisfactory? Would you advise your brother farmers to build silos?

The numbers used for the replies correspond to those of the questions.

Some of the matter used was not received in reply to the inquiries noted, but bears an earlier date, hence the difference in arrangement.

I. H. BUTTERFIELD, LAPEER.

1. In 1886. Have two compartments in bay in barn.
2. Of boards and tarred paper. In one a double coat of paper, with an air space; the other, but one coat of paper and one thickness of boards inside the studs, set up against the girts in bay. Do not see any difference in keeping ensilage between them.
3. Corn mostly, filled once with uncut clover; did not like it, although cattle ate nearly all of it.
4. Have used several kinds of corn, common yellow, white, dent and Southern ensilage; prefer common dent, planted in rows 3½ feet apart, and hills 18 inches apart, or in drills.
6. Using about twelve quarts of seed per acre.
7. At full growth.
8. Estimate, ten tons.
9. ———
10. Put in ten or twelve tons in bottom of one silo in 1888, and filled with cut corn. The uncut came out in good condition, but is not as convenient to feed as that cut; think it a good method for one who wanted but a small silo that would not pay for the expense of preparing for cutting.
11. Slowly, partly because I thought it the best method, and partly from convenience; would fill rapidly, if more convenient.
12. Have packed it well while filling.
13. Tarred paper and boards, think one foot of straw or marsh hay (cut) just as good.
14. Ensilage has kept good with very little weight.
15. Have not filled in a manner to keep any account of expense; would prefer handling the corn in this manner to that of cutting and curing in shock, hauling in and cutting when dry so far as expense alone.
16. About two months.
17. Generally good; occasionally some loss in corners.
18. Think not; practice now uncovering top and taking from surface daily.

Under date of February 22, 1887, Mr. Butterfield says: "I have fed it to all my cattle, one feed per day, making ond-third of the bulk of fodder I feed them. Previous to this they had a feed of hay, which the ensilage took the place of, and to all appearance the ensilage fully supplied the place of

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the hay. I made no tests to afford any positive conclusions in regard to its effect on quantity or quality of milk, but my cows held to their milk well during the *very* cold weather that followed the first of January, and the same cows are doing better in quantity than they did on the same grain and all dry fodder, fed one year ago."

WM. A. BLAKE, GALESBURG, MICH.

1. I built a silo in 1888, in two compartments, each 16 feet square inside measurement, and 21 feet high.

2. It was built in a barn by placing studding inside of the girts and between the cross sill and beams, with two thicknesses of common barn boards, with tarred paper between on the inside of studding.

3. I filled it with corn grown in hills as field corn is ordinarily grown, not intending at the time of planting to put it in the silo.

4–5–6. I think I shall use the same kind of seed for ensilage that I do for the regular field crop, planting in drills three and a half feet apart, and twenty grains to the rod as near as may be.

7. I cut when the corn is as mature as it can be while the fodder remains green.

8. The actual weight of the field corn I placed in the silo was about six and a half tons per acre. Owing to dry weather I think it was about one-half of an average crop.

10. One of my neighbors filled a silo with whole cornstalks bound in bundles. It was not a fair test, however, as a stone wall projected inside of wood lining nearly a foot, and a beam crossed it at the top of the wall eight feet up from the bottom, which prevented the contents from settling uniformly, and the result was a burned, blackened mass, which was quite worthless as animal food.

11. I filled at the rate of 12 tons per day, first filling one, then the other, but shall hereafter alternate between the two, changing from one to the other each day, and shall allow the fodder put in the first day to become heated to quite a high degree before proceeding, and then fill as fast as I can.

12. When filling I kept a man in the silo spreading and treading the fodder, doing most of the packing around the outside.

13. 14. I covered with two thicknesses of boards with tarred paper between and a light covering of earth to fill the crevices and to make sure that the covering shall settle with the fodder, which is all the weighting I deem necessary.

16. 17. I opened the silo about three months after it was filled. Immediately under the covering, to the depth of from four to eight inches, the ensilage was partially spoiled, but all below that was well preserved.

18. I could not discover that it underwent any material change from exposure to the air after being opened.

19. I feed ensilage once a day and dry feed of some kind to complete the day's ration.

20. 21. I feed milch cows one full feed of it once a day, and I think it materially increases the quantity of milk, and the quality, if not improved, is not impaired.

22. I feed ensilage to cattle, sheep and horses with apparent good results. I have not fed it to hogs to any extent.

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23. I know of no other way that so great an amount of fodder can be stored in a given space, and preserved for animal food, as by placing it in a silo and the feed is eaten with more avidity and quite satisfactory results to both animal and owner.

24. I think the ensilage system is now so well established that the silo need no longer be looked upon as an experiment, and in connection with live stock growing it cannot with good economy be dispensed with.

SAMUEL L. FULLER, GRAND RAPIDS, MICH.

1. Three years since—summer of 1887.

2. Of grout—32x70x16 ft. deep—built from the surface, with cement bottom on the level with stable floors; walls one foot thick at bottom and nine inches at top, divided into four compartments, 16x30, inside measure; entrance by 4 ft. doors in end opposite stable. Doors continue through the silos so as to enable feeding by a car holding 30 bushels and run on a 4x4 inch tramway from silos through stable. The cross walls, 30 ft. long, with door in middle, are not heavy enough. Would build of lumber another time, it would be better.

3. Corn only, in different stages of dryness, but the best just before frost, say Sept. 10.

4. Have only used the "B and W," a large Southern corn, successfully. Am not sure it is best. It is late; only bearing roasting ears at best.

5. Have ensilaged field corn that had cured in the shock, but have not made more than a partial success of it. It has not kept as well as the green stalks. The corn was fed without knowing anything about the amount fed, and taken together, the ensilage cured corn has not been a success, not the fault of the corn, perhaps.

6. One kernel to four inches, Some stalks will bear an ear, many will not.

7. Try to escape frost.

8. Never weighed but one-eighth of an acre, that yield was at rate of 61,500 lbs. per acre, an enormous yield. Stalks many of them 15 ft. high and large in proportion.

9. Answered above.

10. Never; I cannot imagine any gain in putting it in whole, unless on a small scale.

11. Fill with teams and men enough to keep the cutting-box running, but no over work or over hours. It is more profit to push the work. The best rule is to work to most profit. The poorest ensilage we have ever had was good enough for us. Have never tried to get sweet ensilage, so called. The cattle seem delighted with all kinds.

12. The tighter it is packed, the better, particularly about the sides and corners.

13. Have covered with two-inch plank a little less in length than the width of the silo, silo 16 ft. wide, plank scant 16 ft., so that in settling the plank will not bind on the side. Cover the cracks with boards and put 18 to 24 inches in depth of seasoned wood on top. Wood is easy to handle and when removed can be drawn where you want it.

14. Have weighted cured stalks too little. Plenty of weight does no harm on any ensilage.

15. Don't ask a farmer what a thing costs. One year the entire expense

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of filling and weighting the silo after the stalks were grown, was 59 cents per ton, calling 45 pounds of settled silage a cubic foot.

16. One and one-half months; don't know why it was not fed from immediately, excepting it was not needed.

17. A little on the top spoiled, perhaps an inch.

18. No; what was uncovered was fed from every day; it would begin to spoil in three days.

19. Fed it alone two weeks to horned cattle and they did well; if silage had been plenty would have kept on.

20. Nothing better but tender grass and that not much.

21. No; the dairywoman could see no difference between good fall pasture and ensilage.

22. No; have no sheep, always heard it would kill horses. I should try it on one horse if I was feeding the horse myself; I don't believe it would be injurious.

23. Storage in silo is far cheaper than any other plan. After drawing stalks from frozen ground, and in deep snow in short days in winter, we gave it up as a very expensive and "bothersome" job. Then we drew them in the fall and cut them with a power cutting-box as we needed. A large pile cut would heat and spoil. We drew them to the barn, which required pitching and loading; then pitching off, and two to put away; then two to pitch them again to the machine. This proved very expensive, and it was this expense that caused the building of the silo. Now we cut the stalks, load them on the trucks or wagon, draw to the machine, put them in the cutting-box and the carrier puts them in the middle of the silo and the job is done in the best and most economical manner.

24. Is partially answered above. I would clear a farm and fence it, build barns for housing my stock, and then build a silo of lumber. I would build it with very little, if any, excavation below my stable floor. If it could be lined inside with double flooring, sound but cheap, I should risk its being tight enough. The outside should be covered with flooring and the studding should be 2x8. If it costs too much to cover the outside the first year let it go. Closely packed ensilage won't freeze much, and taking the little that may be frozen off from the outside every day, it will effect nothing. With such a building one is prepared in the cheapest and best manner to save the winter's food.

It is marvelous the success that has attended the introduction of the silo—the few failures that are reported. It is the one step ahead in farming. It is the green feed the year round. It will double the capacity of the farm for stock raising and that means increasing the productiveness of the entire farm.

What farms need is manure. Manure means stock, ensilage means more stock. One gets a little tired preaching silos, but one should not forget how kind others have been to preach to us.

One cannot have too much ensilage, if well put up it will last indefinitely. A friend in Westchester county, N. Y., fed ensilage five years old and as he claimed perfectly preserved. I advise every farmer to build a silo, raise corn, cut it green in silo and enjoy the profit. Don't be discouraged by the cry of sauerkraut or rot, or any of the reasons that will be given you for not doing by those who have never tried it and know nothing about it by experience.

There is a difficulty that a small farmer will meet with, that is the neces-

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sity of owning a cutting-box and power to cut the stalks. In eastern States parties go about cutting stalks as they do threshing with us. There are many powers that can be utilized for driving a stalk cutter. A stalk cutter for power will probably cost about $60. If by association or otherwise this expense of cutting could be obviated the farmers' millennium would be nearer than ever before. In recommending "B and W" corn, and in answer to query No. 10, I am by no means sure that sweet corn cannot be ensilaged whole to advantage. More stalks to the acre can be cut with a side raker, can be cut earlier and leave ground ready for a fall crop. Ensilaged whole and fed whole (the cattle will do the cutting up), a grappling fork (double ice hooks) to raise the stalks with to put them in silo, would keep them straight and enable close packing. This would be worth trying. Get green feed in winter if possible; get it from corn that will yield from 10 to 30 tons per acre.

H. H. GARFIELD, ALBION, MICH.

1. August, 1888.
2. It is made in one end of the basement of the barn, the wall forming two sides, the other two a board partition, the whole lathed and plastered, the bottom cemented.
3. Corn.
4. Dent. Think it preferable to Flint, as that suckers too much; think the leaves of less value than the matured stalks.
5. Drills, three feet apart.
6. Eight to ten quarts.
7. As soon as the ears begin to glaze; think that at this stage of maturity it is much more valuable than later.
8. From four to ten tons, according to the season.
9. Estimated.
10. Have not; have seen it put in uncut, and it kept nicely, but it is more inconvenient to remove, and cannot get as much in the same space as of that which is cut.
11. Would prefer to fill it slowly as it would be less expensive.
12. I do.
13. Fine or wet straw, plank and stone.
14. In my opinion heavy weighting is preferable.
15. Never made an estimate.
16. Two and a half months.
17. To the depth of three inches it was bleached and very dry; from there on it was quite moist, and had an odor which reminded us of figs. As we worked down it grew somewhat tart.
18. No change as long as we kept the surface level.
19. Feed with grain; think the grain is more perfectly digested when fed with ensilage than when fed alone.
20. Think the quantity is somewhat increased, and the milk has more body.
21. I think it much improved.
22. Not to sheep, but for swine and horses have found it beneficial.
23. It cannot.

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24. I certainly consider it both economical and satisfactory, and would advise the building of silos.

Mr. Garfield also adds: "I have had nearly thirty years' experience in raising corn fodder, and now realize how much I have lost by not having (until now) a proper place to store it for winter use. I have never wintered my stock as cheaply as I have since feeding ensilage."

E. L. LOCKWOOD, PETERSBURG, MICH.

1. Summer of 1888.
2. Of wood, above ground, 30x30x20.
3. Corn only.
4. Location, circumstances, the amount of work, the season, all would modify the question of profit. I planted four varieties—Ohio, or large Dent, Pride of the North, King Phillip, and very small Yellow Flint. This permitted me to plant up to June 17, fully maturing before the heavy frost.
5. Drills.
6. From 6 to 10 quarts, according to variety. If the kernel is large and the stalk small, more seed; if kernel is small and stalk large, less. My corn averaged an ear to each stalk, which I make the object.
7. Fully mature; beginning to glaze or dent.
8. Ten tons. One acre of best land 30 tons.
9. Estimated by your standard per cubic foot settled ensilage.
10. No.
11. Was seven days putting in 150 tons, but put in 40 tons in one day, hoping to know for myself and not for another. Result, sour ensilage. Slow filling saves lateral pressure, and makes sweeter ensilage by generating more heat and settling closer.
12. Ensilage will pack itself, except along the outside. We leave a pile in the center each night as we stop cutting. This will heat rapidly. We fill the corners with this and pack as close as possible.
13. Used two thicknesses of boards, tarred paper between, last year. Shall use only paper next year, with prairie hay, wet straw, chaff, mulch of any kind, the heavier the better.
14. Yes, if you can get the weight on cheaper than you can lose a few inches of ensilage.
15. Seventy-seven cents per ton, exclusive of rent for land. Expect to make it for 50 cents next year.
16. Three months.
17. Perfect, except in two places where boards swelled and raised up, letting the air fall upon the ensilage. This turned black to the depth of six inches in from the end. About three feet further in from the end where the air came in was a white mold. This, although apparently spoiled, was all eaten by the cattle.
18. It was taken out at one end to the depth of five feet at two opposite corners to get at doors opening into mangers for feeding. The ensilage being much looser on top than lower down, took the air, and would re-heat at the edges. But what was left after taking off the top, leaving even surface well packed, did not re-heat or spoil, being left 40 days exposed to the air.
19. Feed once a day, one bushel, mornings, four pounds mixed grain fed

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with the ensilage. Corn stalks at noon. Clover hay, six pounds corn and oats, at night, to each cow.

20. Before opening the silo we were feeding shocked corn, ears and all, the same as put into the silo; the same amount of grain and hay, making all conditions as nearly alike as possible, except ensilage and the same corn dried. The result was to increase the milk about 25 per cent, and butter about the same, on ensilage.

21. No.

22. Sheep none. Hogs and horses eat it greedily.

23. No. Storage space about one-fourth.

24. We have a barn holding 150 tons hay, stabling 36 head of cattle, cost $600. Our silo holds 300 tons, stables for 45 head of cattle, cost $600. Think perhaps the barn will last the longer as it is kept dryer. One-tenth of the land or ten times as much fodder per acre, estimating land at $50 per acre, rent should be $3 per acre. Cost of making one ton of hay and putting in barn, 50 cents; cost of raising and putting in silo of 1 ton of corn the same, 50 cents; product per acre, 1 ton hay, 10 tons corn, or 3 tons hay, 30 tons corn. My yield last year would correspond with the above. My advice to brother farmers to build silos is best conveyed in the fact that I expect to build another silo the coming summer. If I can not sell the farms I must make them pay. The silo promises more help in that direction than anything else in my experience.

C. G. AND J. R. LEARNED, PORT AUSTIN, MICH.

1. In 1886.

2. We have three silos, built continuously. No. 1 is 15x15x26 ft. deep. Nos. 2 and 3 are each 10x15x26 ft., all inside measure. The foundations are all alike. We start on rock foundation three feet below the surface and build a good 18 inch cellar wall for the first 10 ft. This we plaster well on inside with best cement, so that it is a good cistern.

On silo No. 1, the next 10 ft. is built of dressed 2x6 hemlock, laid up elevator style. On silos Nos. 2 and 3 this 10 ft. is a balloon frame of 2x6, sheeted on inside with inch boards put on horizontally. These are covered with two thicknesses of tarred building paper, and over this a course of boards put on perpendicularly.

The last 6 ft. of all the silos are just temporary side boards.

All the walls must be plumb.

3. Corn and clover (large red), corn with pease and oats, and corn only.

4. We use Evergreen Sweet and large Western Dent, planted together.

5. In drills 3 feet apart and about 15 inches in the drills.

6. All we need.

7. When the ears are glazed.

8. If all things are favorable "a big pile."

9. Experience.

10. No.

11. We take plenty of time and fill slowly; one day in one silo and the next in the other. We find our ensilage comes out sweeter and in better shape where it has a chance to heat and the gas so generated to escape before covering.

12. We keep one man in the silo to spread the ensilage and see that it is well and closely packed around next the walls.

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13. Inch boards; paper between.
14. Yes.
15. No account.
16. Fill from the last of September to first part of October. Generally open November 15th to 20th.
17. No; one.
18. No. We uncover a strip five feet wide and feed from top to bottom of silo, and then open another strip.
19–20. We are feeding 47 milch cows this winter, and the flow of milk is nearly the same as from pasture. Our ration is a cubic foot of ensilage per day to each cow, in two feeds, with bran and shorts on it, and what hay they will eat up cleanly after. Ensilage, only, is too loosening a ration.
21. We have a number of milk customers and they are all well satisfied with the quality and flavor of the milk.
22. Yes. Horses like it, and hogs do well on clover ensilage.
23. Decidedly not. After the farmer has his silo filled he will return to it in the morning and wonder if the bottom has fallen out, and he will have a chance to "round it up" three or four times, and then he may begin to look around his field to see if he has truck enough on the place to fill the "confounded thing." We know, from experience, that 17 acres of good corn can be put in a very small place.
24. It has been a success with us, and we consider it a very satisfactory feed, and the cheapest way to preserve fodder. Yes, if a farmer wants to be in the front, to "get there" he must have a silo, well filled.

MERRILL, FIFIELD & CO., BAY CITY, MICH.

Am sorry to say cannot answer all of the questions as fully as desirable, not having facilities for weighing, etc., and only put up silo as an experiment; but am so well pleased with the result will add another one this fall, and know more about it next year. We would not be without a silo if we only had twenty head of cattle and the cost twice as much.

1. Last summer.
2. Having in our barn a bay 16x32 ft., we made two bins, or silos, 16 ft. square, by boarding up on inside of the joist, leaving an air space of 8 inches, and on both sides of joist, or outside and inside, building paper and boards, then planking up inside with two inch plank to hold it firm, making it 16 ft. square.
3. Corn, sowed.
4. Small eight-rowed yellow, white dent, also southern ensilage.
5. Drills; plugged each alternate tooth of a common wheat drill.
6. Don't know.
7. Cut it just before frost came, getting full growth.
8. We had about five acres, estimated 200 tons.
9. Estimated.
10. No.
11. As fast as we could with one medium sized cutter to get the work done.
12. Men tramp down after each load is cut, only moderately.
13. Building paper and boards.
14. Yes, we filled the small loft over silo with pea straw, that was all the

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weighting it had, and that only a month after filling, but am satisfied ought to have left it longer.

15. About 40 cents per ton to put up; can do it for less this year.

16. Opened ours December 2, 1888.

17. Splendid.

18. After feeding two months, taking it out from top to bottom across the silo, the side exposed would mold a little, but would not prevent cattle from eating it.

19. Used it as a midday meal—in the mornings, feed out straw with a little bran or middlings, then turned out until about 2 or 3 o'clock, then put up, and all grown animals given a bushel basket full of ensilage, and young ones in proportion; then sometimes a little hay at night, not often.

20. No experience can tell.

21. Don't know.

22. No, only horses; it does well with them.

23. No, decidedly, no.

24. Yes, we never wintered our herd so cheaply or satisfactorily as this winter; will add one more silo this summer; we have fed about 60 head from the 5 acres from December 2, 1888, to now, March 5, on one silo 16 ft. square, and have one more silo of same size yet to feed, and think it will feed the herd at least six months, from 30 to 60 bushels a day.

C. F. MOORE, ST. CLAIR, MICH.

1. In 1886.

2. In an old barn, fully described in letter of May 18, 1887.

3. Clover and corn.

4. Southern corn; shall use a Michigan dent this year.

5. Planted in drills 3½ ft. apart and about 40 stalks to the rod. This year shall plant in hills 3½ ft. apart each way.

7. When it commences to glaze.

8–9. Estimated at 20 tons per acre.

10. No.

11. I shall endeavor to fill slowly, thus securing sweet ensilage, which being quite mature and sweet, will, I believe, be much better to feed cows suckling calves. The ensilage I am feeding now, being from the immature corn, and being very sour on account of rapid filling, has, I believe, been bad for my calves. Some have died after suffering from colic, which, I think, was caused by their mothers eating the sour, immature fodder.

13. Two thicknesses of boards, with a layer of tarred paper between.

14. I lost much of my ensilage the second year from a lack of weight.

15. I kept no memorandum.

16. Three months after filling.

17–18. In good condition and kept well after opening.

19. Feed ensilage at noon and night and dry hay in the morning. Most of my cattle have had an allowance of bran middlings and ground oats and corn mixed, night and morning.

20–21. I believe ensilage the very best winter feed for milk production.

22. I have fed my horses and colts ensilage once each day, all winter; also fed dry timothy hay once, but no grain. They have done well.

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23. I think more feed can be grown on the same amount of land, and can be stored in less space in the shape of ensilage than any other way. I also believe it the most economical feed that can be produced.

24. I believe every farmer who keeps a dozen or more head of cattle should raise ensilage and have a silo. With well-bred cattle and the silo the farmers of the far west have little, if any, advantage over Michigan farmers.

Under date of May 18, 1887, Mr. Moore writes as follows, concerning his silo and ensilage:

"I only decided to put up some ensilage about a week before it was time to begin filling. I had an old barn that I had no special use for. It had a bay 16x32, which I divided into two parts, put up the girts to nail boards to, then took some old lumber that I had taken from another old barn; these were weather-beaten, of different thicknesses, and a poor lot generally. I put them up and down from the ground to the top. After putting on one thickness of boards I put two thicknesses of tarred paper. I put the two on account of my boards being so poor. Then I put on another thickness of boards, making double boards with paper between. These boards I let into the ground a little to exclude any air which might come in through the bottom. I then put a few loose boards in the bottom for a floor. I began filling by drawing my clover in as we cut it. I used a horse power the first day and found we could not get the clover through the cutter fast enough, the clover therefore became quite dry by night. The next day I got a steam engine, but it did not work well the first half day, so much of the clover in about half of one of the parts became considerably cured. The remainder of that part was put in about as we cut it; the second part was also filled rapidly. It all kept well, both the cured and the other; but we thought that which went in as soon as cut was more as we thought it ought to be, viz: more like green grass. We tramped the whole very thoroughly around the edges, but lost from six inches to a foot all around, also about eight inches on the top. We think the silo ought to have been made of a little better lumber. We also think the next time we fill (which will be this year) we shall put it in as we cut it and not begin cutting till clover is well matured, then will fill rather slowly, tramping well around the edges. We think clover for ensilage ought to be, or rather can be, a little more mature than when cured for hay. There was much less waste in the silo than there was in the cured hay. We think the 36 loads we put in our silo (which we estimated equal to 36 tons of cured hay) went further than twice that quantity of cured hay. I think the silo a success. I think the corn ensilage probably the most profitable, but I think clover ensilage much ahead of clover hay. We feed it twice each day, from December 15 to April 1, to our cattle, and once each day to our colts and mares. Our stock never came through the winter so nicely or so cheaply, and have never been so fat in the spring as this year. Many of our breeding cows are too fat. This may not be due altogether to the ensilage, but we think largely so."

EDWIN PHELPS, PONTIAC, MICHIGAN.

1. Built silo in spring of 1883—11x14x25 feet.

2. It is made by putting up 2x6 studding 18 inches apart, all around, except in one corner, one is omitted for opening from bottom to top, 25 feet. Inch lumber is nailed on inside, then tarred building paper is tacked on,

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then dressed pine boards put perpendicularly inside. The opening has short boards fitted in slots so as to come out in filling and emptying. Tarred paper is also used in the opening, as on sides. The studs are supported bottom and top by sill and plate, in the middle by supports in barn. The bottom is cemented with water-lime. After filling, all is covered with inch boards and paper, same as sides, only not nailed.

3. The first year it was filled with clover and orchard grass mixed, cut when clover was in full bloom, and taken up immediately after mower, not waiting for wet from dew or shower to dry off. We have since used corn.

4. Our corn has been mostly common Yankee dent, with some sweet corn; think the large kinds of sweet make the best ensilage.

5. We have, after much experimenting, found planting in hills gives the best results, 3 feet 8 inches one way and one-half as far the other way, making it about twice as thick as common field corn.

6. About ten quarts of seed is enough per acre for me.

7. We find the best results from cutting the corn about the time it begins to glaze and before the leaves begin to die.

8. Our yield has been from 15 to 20 tons per acre.

9. The past season we weighed every load and had nearly 19 tons per acre, and had it not been so very dry the yield would have been much more.

10. We filled, one year, with corn, bound up in small bundles with marsh grass, and found it a very satisfactory way, except that it did not pack as close and more was injured, but it was very convenient to handle.

11. We fill with our usual farm help without hurry, and in case the stuff does not heat up to 110° Fahrenheit over night lay off a day, when it usually gets warmer than that, sometimes 120°, but last year we found, owing to its being very dry weather, it did not heat as rapidly or as much as I deem advisable. I prefer it should heat to about 120°, believing the ensilage is sweeter and packs more solidly. We are now feeding it and find it a little tart. Our stock relish it well, but I prefer it sweeter.

12. We tramp it as solid as possible, especially at the sides and corners, a man being on it while filling.

13. We cover with two thicknesses of boards, with tarred paper between.

14. Weight moderately with barrels of earth, sufficient to keep the cover down close to the ensilage.

15. Have never made any figures of cost, but last year we put in four acres, 75 tons, in four working days, with four men and three teams.

16. We filled the last of September and commenced using about the first of January following.

17. The condition was then about as now, being warm and moist, a little sourer than now, but I believe the difference is owing to the center being more solid and not on account of time.

18. When first opened, it was rank in smell, sourer in taste than after being exposed to the air. We feed from the top, allowing it to air about 12 hours.

19. Have never fed ensilage alone, but in combination with dry feed. Our practice is to put in a feed of ensilage and mix our grain feed with it twice a day; other feeds cut straw or hay during day and at night.

20. Our cows have always increased in milk and butter when we commenced to feed ensilage, and the women think the butter comes more readily when we feed it.

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21. Have never seen any evil effects on quality of milk from feeding ensilage, either in smell or taste, but I am of the opinion it would affect it, if fed as a whole feed or in excess.

22. Have fed some to horses and pigs with good results, they learning to eat it readily, even greedily. Am now feeding two horses some every day and their hair is smooth and glossy and they feed well. Have not fed it to sheep. I believe shoats can be wintered on it cheaper and better than on anything else we have at hand.

23. I am satisfied after six years' trial that in no other way can so much coarse fodder be put up in so small or economical a manner, or so acceptably or healthy for stock. The cost of silo is so small, and the room it occupies so little, no special protection against frost being necessary.

24. There seems to me no doubt of its utility, and I can heartily recommend to my brother farmers, however small their farms may be, to put in a silo and fill it once. Then I guarantee they will never do without one or more. The cost of a silo that will hold 100 tons need not be over $50, and will be a constant source of profit and comfort.

MARTIN L. SWEET, GRAND RAPIDS, MICH.

1. I built my first silo in July, 1886.

2. It is 36 feet long and 18 feet wide, with a stone wall under it, 8 feet high, laid up with Buffalo cement, and made air tight, and plastered on the inside the same as a cistern. Then I put a wall in the center across the shortest way, leaving the two parts 15x16 feet, and then I put a wooden structure on top with studding 2x10 and 18 feet long. I ceiled it up with common matched flooring on the outside. On the inside I used two inch plank dressed on the inside, plowed and tongued, and spiked onto the studding all round, and on both sides of the partition. I put on an ordinary shingle roof, one-third pitch, with a door 3 feet by 6 in. each, gable end, and then on the sides, for the purpose of taking out the ensilage; had three doors, one above the other, 3 feet wide and 6 feet high each, and hung with ordinary strap hinges.

3. Corn. I have experimented with nearly all kinds.

4. I would recommend Minnesota early sweet corn, and Stowell's evergreen, in equal parts or half and half.

These varieties have proved most satisfactory.

5. I plant in drills, 3 feet one way and 4 inches the other, and one stalk in a place.

6. One-half bushel to the acre.

7. I let the corn stand until perfectly ripe and cut before the frost touches it.

8. About 25 tons to the acre.

9. It is weighed.

10. Never put corn in uncut.

11. I put in about 40 tons a day, commencing and filling one side of my silo, and then the other side. (This silo being divided into two compartments.) I think it makes but little difference whether you pack in slow or fast; the only advantage in packing slowly is that more time is given for the filling to settle.

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12. Yes; as one man can do it. Be sure and keep the outside edges well tramped down while packing.

13. When completed I put on about a foot of straw, then lay on top of that ordinary two inch plank.

14. Weight with stone or with whatever is most convenient. Moderate weight; many say it is not necessary to weight at all, but I have not tried that.

15. To cut and put into the silo, the ensilage cost 35 cents per ton.

16. This year I began to feed six weeks after it was put into the silo, and took the weighting and covering all off the side from which I began to feed.

17. The condition of the ensilage was perfect; no waste at all.

18. It did not change at all after opening.

19. I fed ensilage in connection with other feed, but separately, as to time of feeding.

20. For milk and butter I would not do without it, the quality being as good as from June grass. I am getting as good butter and as much of it as when the cows were fed on June grass.

21. It is certainly efficient, for it makes the best of milk and butter.

22. Have had no experience in feeding to sheep or horses, but think it would be good for either.

23. No; do not believe it can be stored as cheaply in any other way. I do not think any farmer in the country can afford to do without one.

I use an ordinary Ross cutter, with carrier to put the ensilage into the silo. I use a reaper, with dropper, in the field to do the cutting. One team will cut with machine as fast as six men can put it on the wagons. I cultivate with an ordinary cultivator the same as ordinary field corn. I make the land very rich on which I grow the corn, consequently more or less weeds will come up in the rows between the stalks, and, until this year, I have let them grow, and they were gathered with the corn, believing that the seed would not grow after coming from the silo; but finding that the corn would grow after coming from the silo, I concluded not to trust the weeds this year, and pulled them out before cutting the corn.

JOHN P. SANBORN, PORT HURON.

In Mr. Sanborn's absence Mr. Wastell replied briefly to the inquiries.

1. Fall 1884.
2. Of 2x6 plank, planked inside and boarded outside, filled between with sawdust.
3. Corn.
4. Southern sweet corn.
5. Drills two feet apart.
6. Two bushels.
7. At about ten weeks old.
8. Thirty tons.
9. Weighed.
10. No.
11. As fast as possible.
12. Yes.
13. Plank.
14. Yes.
15. Fifty cents per ton.
16. Six weeks.
17. Warm.
18. No.
19. Ensilage and straw.
20. Good.
21. No.
22. Horses.
23. No.
24. Yes; yes.

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JAMES M. TURNER, LANSING, MICHIGAN.

1. I built two silos during the season of 1888.

2. Our largest silo was constructed of wood on a stone foundation. Foundation was 3 feet high above ground, with 2x10 bond timber laid on top and bolted into mason work Size of building 28x40, divided in the middle. Studding 2x10, 22 feet long, with three courses of bridging. Covered studding with two thicknesses of tarred building paper, and sheeted inside with cheap hemlock flooring, dressed and matched, put on horizontally. Outside was covered with 1x6 ship-lapped hemlock strips, dressed. Painted outside with iron ore paint, and inside was painted with hot pitch and coal tar. My smaller silo was made by simply sealing up with common flooring an old bay in the barn.

3. Corn was used for the ensilage.

4. We used large, white Southern corn, as well as smut nose flint corn. Was well satisfied with each. White Southern corn grew larger stalks; but other variety produced a larger yield of ears, which about balanced their value.

5. I planted in drills three and a half feet apart, with Challenge two-horse corn planter, manufactured at Grand Haven, Michigan.

6. Do not remember just how much seed was used, but drill was set to drop a kernel every two or three inches. This provides not only for ensilage, but also for the cut-worms and blackbirds.

7. Our corn last year was cut very late, after it was dead ripe; the severe drought having hastened its maturity. We also had several heavy frosts before ensilage was secured.

8. Our yield per acre varied from 20 to 35 tons.

9. This yield is estimated after weighing perhaps a dozen loads.

10. Have never tried filling silo with uncut corn, as I should consider it much more expensive to handle in feeding out.

11. Our largest silo held about 400 tons, and was filled daily from start; our Smalley cutter cutting about ten tons per hour, while filling was going on.

12. We had one or two men tramping down the ensilage after first day, using particular care in getting corners and sides well packed; we found center would take care of itself.

13. When silo was filled we covered with common inch boards, then laid another course of inch boards crosswise, and loaded heavily by rolling on old sugar barrels filled with sand.

14. I should approve of considerable weight, in order to properly compress top of ensilage. Of course, where silo is deep, the weight of the ensilage affords sufficient compression for the bottom; but I think it is an advantage to use weights to properly compress the top and exclude the atmosphere.

15. We estimated that our ensilage cost about 75 cents per ton, ready for feeding.

16. Our silo was opened and feeding began from it about four weeks after it was filled.

17. The condition of the ensilage had not, to the eye, changed in appearance since putting in, although a strong odor similar to old molasses was quite noticeable.

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18. Have noticed no change in appearance or character since opened.

19. We feed our cattle ensilage twice each day, giving to each animal each time a full bushel basket, together with about four quarts of bran mixed with it. A small ration of hay is given to the same animals once a day.

20. We think our cows gave more and better milk on ensilage than on any other feed we have tried.

21. Could discover no deterioration in quality of milk since feeding ensilage.

22. Our horses and sheep have relished the ensilage quite as much as the cattle, and it seems to entirely agree with them.

23. Certainly no other process with which we are familiar will permit of storing an equivalent amount of fodder as cheaply as in the silo.

24. My experience thus far with the ensilage is more than satisfactory, and it appears to me to be a new way out of the woods for the farmers who have so long been suffering from depression in prices of all classes of farm products. It seems to me that the only hope of future success lies in cheapening the methods of production.

I believe Michigan farmers, through the aid of silos and ensilage, may be able to keep a cow on every acre of tillable land. The ensilage is as available in summer as in the winter; and I don't think we can now afford to pasture our stock, but that the dairy cows will give greater results when fed ensilage, and merely allowed to run out long enough each day to afford proper exercise; and I believe, that by availing themselves of this new system, our farmers who have been keeping ten cows can better keep fifty. The same would apply to feeding steers, or to growing sheep or horses. If our most fertile lands properly treated can be made to produce 35 tons per acre of ensilage, no one can afford to rely upon one or one and a half tons per acre of hay. Neither can they afford to devote the additional area necessary for pasturage.

My impressions are that the silo has come to stay, and that the farmers and stockgrowers will, through its aid, be raised out of their difficulties.

Extract from letter of D. N. Blocher, Millington, dated Jan. 12, 1888:

My silo is 11x14 and 16 ft. deep. Five and one-half feet of it, below the sill of my barn, is made of an 18 inch stone wall, sand and water-lime bottom, six inches of same material above the sill, studded and sheeted on the inside with inch lumber, this lathed and plastered, using one barrel quick and one-half barrel water-lime. Commenced filling September first with corn, about three and one-half feet; then let it stand four days, filled three feet, let it stand three days, then filled as before, and so on until corn was all in. Got the silo about two-thirds full. Put on top six inches poor hay well trod down. Then I covered with boards and plank and weighted with about three tons of stone. Commenced feeding Nov. 26. I keep Jersey cows. Before I commenced feeding ensilage I fed to each cow one bushel of mangolds per day, say about 60 pounds, and all the good hay they would eat. Then I fed 10 pounds ensilage and about one-fourth the amount of hay I had been feeding. In one week the flow of milk increased 25 per cent, equal to what it was in August, and the quantity is very regular, not varying three pounds per day from eight cows, until about five days ago they began to shrink, so that at this date (Jan. 12) they have fallen off 15 per cent. The cause I cannot fully determine. Four calved in April, the balance in June and July. This may be part of the trouble. But about a week ago I allowed

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them to run to a stack of oat straw about three hours a day. The ensilage was not injured by heating, but in digging down I find it spoiled in two corners of the silo, perhaps a ton in each, by not being tramped down solid when put in, and in the way I filled those corners contained mostly leaves of the corn.

EXPERIMENTS WITH ENSILAGE VS. CORN HARVESTED IN ORDINARY WAY.

Is an acre of corn, put in the silo, worth more to feed cattle, than if cut and dried in the ordinary way, feeding the grain and fodder in combination? The experiment herewith reported was undertaken with the hope of securing some information on this much mooted question.

Last September one and a half acres of good ensilage corn, sowed thin in the drill (of Hathaway and Hibbard varieties, seed mixed) and well eared, was cut up when nicely glazed, weighed and put in our small silo. From the one and a half acres 25,060 pounds of corn ensilage were obtained. One and a half acres adjoining, and to all appearance equal in every respect, was cut and shocked in the ordinary way. When dry, in October, the corn on last named plat was husked and 5,310 pounds of fairly dry corn was obtained, much of which was sound. The stalks were bound and shocked and left until fairly dried. When drawn to the barn and put away for winter feeding they weighed 5,975 pounds.

Five cows giving milk were placed on the east side of the experimental barn and five dry cows in the stalls on the opposite side.

Two of the milch cows were Shorthorns, two Holsteins and one Ayrshire. Four of the dry cows were Shorthorns, the other a Devon.

The following brief descriptions of the animals give some items necessary for the best understanding of some points of the experiment:

Phœnix 12th, Shorthorn, calved Nov. 12, 1877; last calf July 13, 1888.

Lulu of Lansing, Ayrshire, calved Nov, 18, 1878; last calf May 12, 1888.

College Phœnix 2d, Shorthorn, calved Nov. 7, 1885; last calf Sept. 15, 1888.

Soutje, Holstein, calved Nov. 18, 1878; last calf April 2, 1888. Soutje was dried off Feb. 28, and had been milked but once daily for a week before.

College Mae, Holstein, calved June 3, 1884; last calf Oct. 2, 1888.

Bonny Red Rose 2d, Shorthorn, calved Oct. 12, 1874; last calf June 17, 1888.

Crystal Queen 9th, Shorthorn, calved June 7, 1876; last calf Jan. 5, 1888.

Heroine, Shorthorn, calved March 18, 1876; last calf Jan. 5, 1888.

Jennie Baldwin 2d, Shorthorn, calved Jan. 15, 1885; last calf Oct., 1888.

Lovely 27th, Devon, calved July, 1877; last calf May 14, 1888.

After a week's preliminary feeding the experiment began Dec. 15, 1888. Dried cornstalks were fed for a period of three weeks, then ensilage was substituted for the dried fodder for three weeks, then returned to dried fodder the third period, and then ensilage the fourth period, making two periods each of three weeks for dried fodder and the same for ensilage.

The dried fodder was run through the cutting-box; the corn was crushed and the cob meal fed with the dried stalks, while an equal amount of bran and two pounds of clover and timothy hay were fed daily with both dried fodder and ensilage. Each ration was weighed, and whatever was left was

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weighed back. Only the actual amount consumed is reported. Careful records were kept of each milking, and the cows were weighed each week.

Tables one and two give names of the animal, date of period, grain, hay, ensilage and dried fodder consumed; pounds of milk, weight of animals at beginning and close of periods, with gain or loss.

The milch cows were in that time from calving, when there is quite a marked shrinkage in product, and one was entirely dry before the completion of the test. See milk yield of Soutje in tables.

Four of the dry cows were old and had suckled calves until late in the fall, and were much reduced in flesh, so that the gains were light during the first periods of feeding.

During the dry fodder periods the daily grain ration was 14 pounds to each cow, made up of varying amounts of wheat bran and cob meal, averaging five pounds of bran, two pounds of hay daily, and what corn fodder they would consume.

During the ensilage periods the daily ration was five pounds of wheat bran, two pounds of hay, and from 30 to 60 pounds of ensilage.

TABLE I.—*Dry Feed alone.*

Name of animal.	Date of periods.	Grain—lbs.	Hay—lbs.	Dried corn fodder—lbs.	Milk—lbs.	Weights.			
						At beginning of period, Dec. 14.	At close of period.	Gain.	Loss.
Phœnix 12th	Dec. 15 to Jan. 4	252	42	278	398	1,210	1,150	.....	60
	Jan. 26 to Feb. 15	336	42	205	383	1,195	1,170	.....	25
College Phœnix	Dec. 15 to Jan. 4	252	42	280½	501⅓	1,070	1,020	.....	50
	Jan. 26 to Feb. 15	336	42	222	441⅓	1,050	1,040	.....	10
Lulu of Lansing	Dec. 15 to Jan. 4	252	42	265⅓	327	920	880	.....	40
	Jan. 26 to Feb. 15	336	42	197	286½	960	985	25	.....
Soutje	Dec. 15 to Jan. 4	252	42	361⅓	326	1,250	1,230	.....	20
	Jan. 26 to Feb. 15	336	42	344	111⅓	1,305	1,360	55	.....
College Mac	Dec. 15 to Jan. 4	252	42	293	579	1,120	1,080	.....	40
	Jan. 26 to Feb. 15	336	42	305	511	1,180	1,180	0	0
Bonny Red Rose 2d	Dec. 15 to Jan. 4	246	42	97	.....	1,120	1,180	60	.....
	Jan. 26 to Feb. 15	335⅓	42	165⅓	.....	1,247	1,295	48	.....
Crystal Queen 9th	Dec. 15 to Jan. 4	252	42	238⅓	.....	1,500	1,510	10	.....
	Jan. 26 to Feb. 15	335⅓	42	157	.....	1,505	1,505	0	0
Heroine	Dec. 15 to Jan. 4	252	42	211⅓	.....	1,180	1,160	.....	20
	Jan. 26 to Feb. 15	335⅓	42	174⅓	.....	1,220	1,208	.....	12
Jennie Baldwin 2d	Dec. 15 to Jan. 4	252	42	241⅓	.....	1,230	1,230	0	0
	Jan. 26 to Feb. 15	335⅓	42	207½	.....	1,290	1,320	30	.....
Lovely 27th	Dec. 15 to Jan. 4	252	42	156	.....	1,090	1,080	.....	10
	Jan. 26 to Feb. 15	335⅓	42	145	.....	1,080	1,140	60	.....
Totals	.....	5,871⅓	840	4,545⅓	3,865	.....	.....	288	287

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TABLE II.—*Dry Feed and Ensilage.*

Name of Animal.	Date of Periods.	Grain—lbs.	Hay—lbs.	Ensilage—lbs.	Milk—lbs.	Weights.			
						At beginning of period.	At close of period.	Gain.	Loss.
Phœnix 12th	Jan. 5 to Jan. 25	126	42	911	389½	1,150	1,195	45	....
	Feb. 16 to March 8	84	42	823	339	1,170	1,110	.....	60
College Phœnix	Jan. 5 to Jan. 25	126	42	876	462½	1,020	1,050	30	....
	Feb. 16 to March 8	84	42	823	376½	1,040	1,020	.....	20
Lulu of Lansing	Jan. 5 to Jan. 25	126	42	911	299½	880	960	80	....
	Feb. 16 to March 8	84	42	823	247½	985	970	.....	15
Soutje	Jan. 5 to Jan. 25	126	42	1,171	255½	1,220	1,295	75	....
	Feb. 16 to March 8	84	42	1,148	20½	1,360	1,400	40	....
College Mae	Jan. 5 to Jan. 25	126	42	1,171	545	1,080	1,180	100	....
	Feb. 16 to March 8	84	42	1,148	464	1,180	1,170	.....	10
Bonny Red Rose	Jan 5 to Jan. 25	126	42	842	.....	1,180	1,247	67	....
	Feb. 16 to March 8	84	42	823	.....	1,295	1,370	75	....
Crystal Queen 9th	Jan. 5 to Jan. 25	126	42	872	.....	1,510	1,505	.....	5
	Feb. 16 to March 8	84	42	618	.....	1,505	1,470	.....	35
Heroine	Jan. 5 to Jan. 25	126	42	930	.....	1,160	1,220	60	....
	Feb. 16 to March 8	84	42	823	.....	1,208	1,235	27	....
Jennie Baldwin 2d	Jan. 5 to Jan. 25	126	42	975	.....	1,230	1,290	60	....
	Feb. 16 to March 8	84	42	968	.....	1,320	1,330	10	....
Lovely 27th	Jan. 5 to Jan. 25	126	42	548	.....	1,080	1,080	0	0
	Feb. 16 to March 8	84	42	578	.....	1,140	1,150	10	....
Totals		2,100	840	17,782	3,379½	.....	.....	679	145

TABLE III.—*Totals by Groups.*

Group.	Period.	Food Consumed—Pounds.							Milk. Pounds.		Gain + or Loss −. Pounds.	
		Hay.	Bran.	Corn and cob meal.	Dried corn fodder.	Ensilage.	Total.	Daily average per cow.	Total.	Daily average per cow.	Total.	Aver. per cow.
5 milch cows	1st 3 weeks	210	624	636	1,478½	.....	2,918½	28.1	2,131½	20.3	−210	−42
" "	2d "	210	630	.....	.....	5,040	5,880	56	1,932	18.4	+330	+66
" "	3d "	210	336	1,344	1,273	.....	3,163	30.1	1,733½	16.5	+ 45	+ 9
" "	4th "	210	420	.....	.....	4,765	5,395	51.4	1,447½	13.8	− 65	−13
" "	1st & 3d 3 wks	420	960	1,980	2,751½	.....	6,111½	29.1	3,865	18.4	−165	−33
" "	2d & 4th "	420	1,050	.....	.....	9,805	11,275	53.7	3,879½	16.1	+265	+53
5 dry cows	1st 3 weeks	210	620	634	944½	.....	2,408½	22.9	.....	.....	+ 40	+ 8
" "	2d "	210	630	.....	.....	4,167	5,007	47.6	.....	.....	+182	+36
" "	3d "	210	336½	1,342	849½	.....	2,737	26.1	.....	.....	+126	+25
" "	4th "	210	420	.....	.....	3,810	4,440	42.2	.....	.....	+ 87	+17
" "	1st & 2d 3 wks	420	956½	1,976	1,794	.....	5,145½	24.5	.....	.....	+166	+33
" "	3d & 4th "	420	1,050	.....	.....	7,977	9,447	45	.....	.....	+269	+54

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It will be seen that the milch cows gave 485½ pounds more milk on dry fodder than ensilage. This is, in a measure, accounted for by the natural shrinkage. This may be seen by comparing the yield for the first period of ensilage feeding with the second period of dried fodder immediately following. The greater yield was during the feeding of ensilage, showing that the decrease was the natural result of the lengthening of the period of lactation. Soutje drying off during the last period on ensilage should also be taken into consideration.

The 1½ acres of corn made 25,060 pounds of ensilage, 21,125 pounds were weighed from the silo, a little more than one-eighth of loss.

Of this 21,125 pounds, 15,890 pounds, or about three-quarters, were fed, the remaining 5,235 pounds being classed bad. There was waste and loss in being obliged to cart it from the silo to the barn where it was fed; 1,892 pounds from another silo was required to complete the last four days of the feeding.

The acre and a half of ensilaged corn, therefore, furnished the bulk of the food of ten cows for nearly six weeks. From 1½ acres was obtained 5,310 pounds of grain fairly dry. The stalks when put into the barn, November 23, weighed 5,975 pounds. The total weight of grain and stalks was 11,285 pounds, not quite half the weight of the corn ensilaged.

The first load was put into the experimental barn Dec. 14, the last Jan. 31, they having been stored in the grain barn in the meantime. The total weight was 5,625 pounds, a shrinkage of 350 pounds from Nov. 23. These lasted until Feb. 6, when stalks grown in another field were drawn to be used with the remainder of the cob meal, making something like a week of feeding from the latter; 6,313 pounds were weighed out to the cows in the six weeks when dried fodder was fed, and they consumed 4,545 pounds, a waste of 1,768 pounds, the larger, coarser parts of the stalks not being eaten.

The 5,310 pounds of corn in the ear made 4,219 pounds of corn and cob meal.

The ten cows consumed 3,955 pounds of corn and cob meal, 264 pounds less than the full amount—not a very great difference when two facts are considered: One lot of meal was very damp, and was spread and turned frequently, and there was a large shrinkage; for the feeding of the ten cows three times daily for six weeks, or 42 days, 1,260 weighings were necessary. In so many weighings there would necessarily be some loss.

The experiment shows that the ensilage, although nearly a quarter of it had spoiled from a lack of care in filling and partly from exposure during the interim of dried fodder feeding, lasted longer than the stalks and corn and cob meal, that the cows made more pounds gain on it than on the dried fodder and meal. There can be no doubt that it was cheaper. The fact of the greater number of times the dried stalks were handled over more than the corn made into ensilage, and the labor of husking the corn would add to the cost of the dried fodder. The hauling of the corn and crushing into meal would also add to the cost.

The following items embrace the cost of preparing the corn fodder in the ordinary way:

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Cutting and shocking one and one-half acres at $1.00	$1 50
Husking 106 bushels ears and cribbing same at four cents	4 24
Drawing 5,975 pounds of corn stalks to barn	1 50
Cutting of same at 75 cents per ton	2 25
Drawing two loads of corn to mill, and meal home	2 50
To crushing and grinding 5,310 pounds of corn at 10 cents per 100	5 31
Total cost	$17 30

The cost of one and one-half acres of corn, or 12½ tons of ensilage, in silo at 70 cents $8 75

Which would leave a balance of $8.55 in favor of ensilage.

The labor of feeding the ensilage all prepared and mixed will be much less than in feeding the dried fodder. Some who favor the dried fodder may object to the expense involved in cutting. If the fodder should be fed long and the grain unground, even then the cost would be only $1.00 less per acre than the ensilage. There are few feeders who would consider it economical to feed the corn in the ear.

COMPARATIVE TEST OF VARIETIES OF ENSILAGE CORN.

Comparative test of varieties to determine their value for ensilage.

Those who have been most successful in making good ensilage prefer a variety of corn that produces both a large amount of good fodder and ears in the roasting stage or just beginning to glaze.

Several varieties, recommended for ensilage, were planted for the purpose of determining which, in our climate and on our soil, most perfectly combined these two points.

The soil, a sandy loam, was thoroughly prepared for the crop.

On May 19, 1888, the following varieties were planted in drills 3 feet 9 inches apart: Deitz Golden Yellow, Golden Beauty, White Giant Normandy, Breck's Boston Market, Wisconsin White Dent, Leaming Yellow Dent, Chester County Mammoth, Southern Ensilage, Parish White Dent. Owing to unavoidable delay in receiving the seed, the Burrell and Whitman was planted some two weeks later than the other varieties, as was also Sweet's, the seed of which was obtained from Hon. M. L. Sweet, of Grand Rapids, who has grown it several years and found it an excellent variety. The weeds were kept down by thorough cultivation during the entire growing season.

The yield of corn was lessened by the severe drought, prevalent a good part of the season. The following notes, made during the growing season, will aid in giving some idea of the habits of growth of each variety.

Deitz Golden Yellow.

June 20.—Has not made rapid growth; has a good stand; the leaves are ong, narrow and good color.

June 28.—Seventeen inches high.

July 2.—Height of two feet.

July 23.—About five feet high; has made an even growth. The stalks are medium size and well leaved.

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Aug. 4.—Five to seven feet high.. Beginning to tassel.
Sept. 4.—Beginning to turn; some stalks quite dry half way to top, others green to the ground; ears beginning to fill; 21 stalks per rod; 8½ feet high; 71 ears to 100 stalks in drill.

White Giant of Normandy.

June 20.—Has made a fair growth; has a good stand; is not so well leaved as some of the others.
June 28.—Twenty-three inches high.
July 2.—Dark green; thrifty stalk; four feet high.
July 23.—One of the largest and coarsest varieties grown; stalks very heavy, with a good supply of coarse leaves.
Aug. 4.—From 5 to 10 feet high; nearly all tasseled.
Sept. 4.—Stalks partially dried; ears well filled with grain in the milk; 19 stalks to the rod, 8½ feet high; 82 ears to 100 stalks in drill.

Golden Beauty.

June 20.—Has a fair stand.
June 28.—Doing well; 17 inches high.
July 2.—Even growth; height 2½ feet.
July 23.—Uneven; from 2 to 5 feet high.
Aug. 4.—Rather thin in drill; large, coarse leaves and stalks.
Sept. 4.—Ears in roasting stage and well filled; stalks still green but turning in some places; 17 stalks per rod, 8½ feet high; 68 ears to 100 stalks in drill.

Breck's Boston Market.

June 20.—Fair stand; seed was not good.
June 28.—Thin in drill; healthy growth; 17 inches high.
July 2.—Two and a half feet high.
July 23.—The tallest stalks are 6 feet high; large, heavy stalks, well leaved; suckers coming up in abundance about the roots.
Aug. 4.—Rather late.
Sept. 4.—Turning some; ears fairly filled; grain in the milk; 17 stalks per rod; 8 feet high; 82 ears to 100 stalks in drill.

Wisconsin White Dent.

June 20.—Good color and has made a good growth.
June 28.—Even growth; 22 inches high.
July 2.—Dark color, 2½ feet high.
July 23.—Stalks from 4 to 6 feet high; half the stalks tasseled.
Aug. 4.—Earliest of all; ears formed and silked; large stalks 6 to 8 feet high.
Sept. 4.—Ripening fast; almost out of the roasting stage; 21 stalks per rod; 7 feet high; 85 ears to 100 stalks in drill.

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Leaming Yellow Dent.

June 20.—Dark color; has made good growth.
June 28.—Twenty-two inches high.
July 2.—Even growth and of good color.
July 23.—Taller than any other variety; fine stalks.
Aug. 4.—Stalks well leaved; 5 to 8 feet high and tasseling.
Sept. 4.—Half ripe; grain beginning to glaze; 25 stalks to rod; 8¾ feet high; 62 ears to 100 stalks in drill.

Chester County Mammoth.

June 20.—Over 12 inches high. Large, strong stalk and broad leaf.
June 28.—Twenty-two inches high.
July 2.—Vigorous and even growth; 3 feet high.
July 23.—Over 6 feet in many places; stalks finer than Parrish dent, fairly well leaved. A large amount of fodder will be obtained.
Aug. 4.—Five to eight feet high, and tasseling.
Sept. 4.—Stalks half ripe. Grain in the milk; 22 stalks to rod; 8¾ feet high; 48 ears to 100 stalks in drill.

Southern Ensilage.

June 20.—Ten to 12 inches high.
June 28.—Even growth; 22 inches high.
July 2.—In the main, vigorous growth and good color.
July 23.—Five and a half feet high in best places.
Aug. 3.—Later than other varieties; 7 feet high and very green.
Sept. 4.—Ears scarcely formed in many places; stalks drying at roots; 24 stalks to rod; 8½ feet high; 29 ears to 100 stalks in drill.

Parrish White Dent.

June 20.—Good color and stand; 10 to 12 inches high.
June 28.—Thin in drill, with many small stalks; 22 inches high.
July 2.—Two and a half to three feet high.
July 23.—Five and a half feet high in best places; stalks are large and quite well leaved; coarser than Southern ensilage.
Aug. 5.—About 7 feet high; still green.
Sept. 4.—Ears fair size, fairly filled; grain in the milk; 23 stalks per rod; 33 ears to 100 stalks in drill.

Burrill and Whitman's.

June 20.—Growing rapidly; has good stand; sown two weeks later than other varieties, but seems likely to outstrip them.
June 28.—Has made even growth; 22 inches high.
July 23.—Four and one-half to five feet high. The stalks are medium size with many long, narrow leaves. More leaves than any other variety.
Aug. 4.—Five to eight feet high.

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Sept. 4.—Turning rapidly, only tops still green; 31 stalks to rod; seven and one-half feet high; four ears to 100 stalks in drill.

Sweet's.

Sept. 4.—Leaves green; ears just forming; seven and one-half feet high. This is doubtless the result of the late planting.

The Hathaway Dent.

This is a variety of field corn that has been grown for some years on the College farm. That referred to in the table was grown in the same field and under the same conditions as those already noted.

The following table gives, in summarized form, the following points of comparison:

Number of rows, height of stalk, number of stalks per rod, number ears to 100 stalks, date of cutting, weight when cut, weight of one row.

The height, number of stalks per rod, number ears to 100 stalks and weight of one row are averages. Yield per acre is estimated from weight of one row. The corn was cut, weighed, prepared and placed in the silo Sept. 4, 5 and 6.

B. and W. and Sweet's are placed in the table to show amount of fodder obtained.

Name and Variety.	Date of planting.	Number of rows.	Height of Stalks.	Number of Stalks per rod.	Number ears to 100 stalks.	Date of cutting.	Weight when cut.	Weight of one row.	Estimated yield per acre.
Wisconsin White Dent	May 19	2	7	21	85	Sept. 5	1,025	512½	18,320
Hathaway	" 19	....	.....	20	86	.....	.....	.....	.....
White Giant Normandy	" 19	4	8½	19	82	Sept. 6	2,820	705	22,560
B's B. Market	" 19	3	8	17	82	" 5	1,440	480	15,360
Deitz Golden Yellow	" 19	2	8½	21	71	" 6	1,250	625	20,000
Golden Beauty	" 19	3	8½	17	68	" 6	1,780	593½	18,986
Leaming Yellow Dent	" 19	4	8¾	25	62	" 5	2,600	650	20,800
Chester Co. Mammoth	" 19	4	8¾	22	48	" 5	2,640	660	21,312
Parrish White Dent	" 19	6	7	23	31	" 4	4,945	824⅛	26,373
Southern Ensilage	" 19	4	8½	24	29	" 5	3,205	801¼	25,640
B. and W.	June 1	4	7½	31	4	.....	2,655	663¾	21,240
Sweet's	" 1	6	7½	.....	3	.....	3,580	596⅔	19,093

While the Wisconsin White Dent did not grow so tall as some of the other varieties, and did not have so great number of stalks to the rod, it gives the largest number of ears, and reference to the notes shows that they were nearly out of the roasting stage Sept. 4.

The Hathaway almost equals it in regard to stalks and ears. There are no notes on the condition of the grain, but it is a later variety, and the grain was probably less valuable at this time for the silo.

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White Giant of Normandy is also a rival. While the number of stalks per rod, and ears per 100 stalks are not so large, it grew higher and the average weight of a row is 200 pounds more than that of a row of Wisconsin White Dent. The grain was not quite so ripe, but was good.

Breck's Boston Market compares favorably with the two mentioned, except in weight. This cannot be attributed to the fact that it was drier, for it was the greenest of the three when cut.

For convenience we will group Deitz Golden Yellow, Golden Beauty and Leaming Yellow Dent. A glance at the table shows that the height of the three varieties was nearly the same. The number of stalks per rod varies from 17 to 25, and of ears per 100 stalks from 62 to 71. The Leaming, with the greatest number of stalks, has the least number of ears. Golden Beauty, the least number of stalks and more ears than the Leaming; fewer than the Deitz. The Leaming was the ripest, the Deitz the greenest. It will be noted that the weight of a single row of the several varieties varies considerably.

The Chester County Mammoth, the Parrish White Dent and the Southern Ensilage gave a small amount of grain.

The Chester County Mammoth and Parrish White Dent, however, had ears fairly filled and the grain was in the milk. Most of the ears on the Southern Ensilage were just formed.

It would be unfair, because of their later planting, to compare the B. & W. and Sweet's with those mentioned, although the weights show that there was a large quantity of fodder from these two varieties.

The earing of the different varieties plainly enforces the value of thin seeding to secure the best and largest product, of combined grain and stalk, suitable for ensilage.

From 17 to 21 stalks per rod, giving the greatest number of ears per 100 stalks, or from 68 to 86. And it will also be noted that the ears were more mature than the others.

The B. & W., with 31 stalks to the rod, gives only 4, but the lateness of planting may be in a measure the cause of this.

The Leaming, with 25 stalks to the rod, gives 62 ears, while the Southern Ensilage, the Chester County Mammoth and the Parrish White Dent, with a less number of stalks to the rod, also give a fewer number of ears to 100 stalks.

FORAGE PLANTS.

The following forage plants were grown last season. Only small plats were sown, as the test was mainly to determine how they would thrive on our soil and in this climate.

The soil was like that on which the corn was planted, and was prepared in the same manner.

Seed was sown May 19. Most of the seeds were received from the United States Department of Agriculture.

Serradella—This plant made very little growth, which may, perhaps, be accounted for by the drought, as Dr. Goessmann, of the Massachusetts experiment station, reports it as doing best on moist, deep, sandy soil. He also reports it as yielding about ten tons of green fodder to the acre, of which one-fifth was actual vegetable matter. Time of seeding and mode

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of cultivation are about the same as for peas. The growth of the plant is slow until it blooms, when it rapidly increases in size and nutritive constituents. The close of the blooming period (about September 1, in Massachusetts) is the best time for cutting the crops.

Director Armsby, of the Pennsylvania experiment station, reports "That the plant yields about the same amount of starch and fat per acre as clover hay, but much less of every other nutriment except the ash or mineral elements, which were present in great abundance."

Spergulum Maxama grew rapidly for a time, but was injured by the dry weather.

Sheep Fodder Vicia Velosa, a spreading plant that grows close to the ground and resembles the vetch.

Yellow Lupine made a good start, but made little growth afterward.

Vetches.—These were still green Sept. 14 and had a few pods, but the growth was small.

Brazilian Flour Corn.—The field notes speak of this variety as looking like common corn. Grew slowly and stooled more than common corn. The leaves were narrow and rolled close with a rough inner surface. Sept. 14 it was still green and the ears were just forming.

Kaffir Corn.—A variety of sorghum, cultivated for both forage and grain. Two rows were drilled and two planted in hills. It did not grow so well as some of the other varieties. The drilled was the better during the entire season. Grew to a height of five and one-half feet. The stalks were covered with a substance that rubbed off readily and looked and felt like flour. No ears formed.

Camaroon Corn.—This somewhat resembled millet and made a good growth until July 23, when it seemed somewhat affected by the dry weather. The stalks were about as large as an ordinary lead pencil. Averaged three and one-half feet in height. A few soft, bushy heads, covered with red hairs. Did not resemble any of the other varieties of corn.

Teosinte (*Euchloena luxurians*).—Seed was sent from the United States Department of Agriculture with the following description: "A luxuriant forage plant which has not yet become sufficiently acclimated to produce seed north of Florida or the thirty-first degree of latitude. An annual crop of green or dry fodder or ensilage can be grown as far north as the fifty-first parallel. Stock of all kinds are exceedingly fond of it, either green or cured." It grew to a height of four and one-half feet. Stalks were small with long, narrow leaves.

The Brazilian Flour, the Kaffir, the Camaroon corn and the Teosinte were all sown too thick, and would doubtless have given better results with less seed.

The Caucasian Prickley Comfrey has been very highly spoken of as a forage plant by some of the stations. It, however, did not give promise of great value here. Prof. Brown, of Guelph, Ontario, who has given it a thorough trial, decided it was of little value to them.

From the results obtained it will be seen that very few of these plants merit another trial.

The comparison of these plants with the ensilage corns, growing side by side, taught very emphatically the lesson that with our climate and soil, corn is far superior as a forage crop.

The majority of evidence is in favor of corn for ensilage that is nearly, if

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not quite, mature. Few of the plants had more than small heads just formed, while many of them had none. Either fact would make them of little value for ensilage.

GRASSES AND CLOVERS.

One acre plats of the following grasses and clovers were sown in experimental field No. 3. The ground is rather sandy, especially where the Alfalfa is sown. It received a good dressing of manure, and was plowed seven inches deep, harrowed, rolled and sown with a wheelbarrow drill and covered with the Vaughn flexible harrow. The ground was again rolled, leaving it very smooth.

Plat No. 1 (one acre) was sown with four bushels of Orchard grass seed. It came up in about two weeks and made a fine growth, covering the ground June 9. This grass kept the start of the weeds which came up more or less all over the piece.

Plat No. 2 (one acre) was sown with 20 pounds Alfalfa seed. This came up in one week from date of sowing and continued to grow, and June 9 covered the ground fairly well. The highest plants were four inches above the ground, and the roots extended lower than this below the surface. A frost on the night of June 1 injured the Alfalfa to quite an extent.

From the appearance of this plat I would sow more than 25 pounds of seed rather than less.

Plat No. 3 (one acre) was sown with 3 bushels of Red Top. This seed came up in about three weeks. It seemed to take longer to germinate than either the Orchard grass or the Alfalfa. It covered the ground June 9, having made a very good start.

Plat No. 4 (one acre) was sown with a mixture of 1 bushel Red Top, 4 quarts Red clover, 4 quarts White clover, 2 quarts Timothy, and 4 quarts Alsike clover, this mixture making nearly 4 bushels in bulk. The clover was up in about a week. The grasses were up about the same time as those in the other plats. This amount of seed made a very thick mat of grass and kept the weeds back very thoroughly.

The Orchard grass was light in color and did well until the last of July, when it was considerably affected by the dry weather. In low places and in spots where thinly seeded it was not so badly affected.

The Alfalfa was dark green, and until affected by the drought in July, when it turned yellow, made a fair growth; although some of it seemed dead, the roots were not affected, and later in the season it revived and made a fair growth.

Red Top was thick and grew well. In color it resembled the Blue grass. It suffered from the drought; but a little of it was headed July 23.

The mixture of grasses was less affected by the dry weather than any of the others. The Alsike and Red clover were from four to six inches high July 23. The Orchard grass larger in low places. The White clover small but very thick, and the Red Top was in blossom.

The Alfalfa or Lucerne feeds mainly from the subsoil, and for this reason many fail to obtain as good results with it as they look for. It thrives best on old soil, that which has received deep, thorough tillage for some years. Another year of trial will enable us to speak with more definiteness of the value of these clovers and grasses.

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In conclusion, I mention with sincere appreciation the value and aid rendered by my assistant, Alice A. Johnson, in the preparation of this bulletin.

We send it out with the hope that many farmers in our Peninsula State may be induced by the experiences herein narrated to build and fill silos the coming summer, and may glean from the results of the experiments recorded some lessons of real practical service to them.

SAMUEL JOHNSON,
Prof. of Agriculture.

AGRICULTURAL COLLEGE, MICH.,
April 10, 1889.

NO. 48. HORTICULTURAL DEPARTMENT.

1. POTATOES.
2. KALE.
3. EXPERIMENTS WITH SQUASHES.
4. TOMATOES.

The work in this department since it came into the charge of the writer on the 16th of August, has been confined to the closing up for the year of the work undertaken by his predecessor.

The frosts during the last week in August destroyed the collections of squashes, peppers and egg-plants, while the dry weather so hindered the growth of other crops as to prevent their maturity. The observations made were confined for the most part to the following, viz.: Tomatoes, potatoes, kale, hybridized squashes. Careful notes and weights were taken; they were also photographed and seeds saved for next year's use.

I. POTATOES.

The tests of potatoes were confined almost entirely to seedlings that were sent here for trial, many of which are to be placed on the market next spring. Most of them were planted in a very light soil, where they were badly injured by the drought. As a rule only one tuber of a kind was used, and these, cut to one eye pieces, were planted one foot apart, with three feet between the rows.

COY'S SEEDLING No. 88.—(Now named Burpee's Superior.)—From W. Atlee Burpee & Co., Philadelphia, Pa. (Fig. 1, Plate 1.)

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One tuber, cut to thirteen pieces, yielded 17 pounds 1 ounce, or at the rate of 318 bushels per acre. Tubers all marketable and very even in size; very smooth and regular with ends abruptly rounded. Eyes few and near the surface. Season, medium. In quality, one of the very best. Flesh white and mealy when cooked. The most productive and promising potato grown the past year.

EARLY OXFORD.—From J. J. H. Gregory, Marblehead, Mass. (Fig. 2, Plate 1.)

One tuber, cut into 13 pieces, yielded 13 pounds 1½ ounces, all of which were merchantable. In shape, somewhat elongated but quite smooth and regular. Eyes few and shallow; skin pinkish white. Quality is excellent. It seems to be a good keeper, and as an early variety is well worthy of trial.

RURAL NEW YORKER No. 2.—From J. M. Thorburn & Co., New York City. (Fig. 3, Plate 1.)

One tuber furnished 12 one eye pieces and yielded 11 pounds 3 ounces, all of good size. In form, nearly as broad as long and flattened. Skin white; eyes few and inconspicuous. Generally very smooth and regular, although an occasional prong manifests itself. Flesh very white and mealy when cooked. This potato is quite productive and is an extremely valuable variety. Had it been grown under better conditions it might have headed the list. Well worth planting.

NEW QUEEN.—From J. J. H. Gregory, Marblehead, Mass. (Fig. 4, Plate 1.)

One tuber furnished 12 single eye pieces and yielded 9 pounds 8 ounces. It is said to be a seedling of the Beauty of Hebron, and in general appearance it resembles that variety. Gregory, in his catalogue, figures the tubers as being much more slender than they are with us. Eyes large, but few in number, and not deep. A fine looking potato and of excellent quality, but it did not prove very productive here, although others speak of it as a "wonderful cropper."

JUNE EATING.—From Thos. Crane, Fort Atkinson, Wis.

Twenty-four single eyes yielded 22 pounds 10 ounces of merchantable tubers with no small ones. Tubers elongated and nearly cylindrical, with the ends evenly rounded. Eyes large but not sunken. Quite smooth and regular. A very promising early variety.

EXTRA KEEPER.—From Thos. Crane, Fort Atkinson, Wis.

Twenty-four pieces yielded 8½ pounds of medium sized potatoes. In shape nearly round, somewhat flattened, skin smooth and pinkish white in color. Eyes not conspicuous; season late. Apparently a good keeper, but its trial here shows that it is a light cropper upon light soils. Its appearance would indicate that it is better adapted to rich, heavy soils, and there it may prove productive.

SEEDLING No. 38.—From Colorado Agricultural College, Fort Collins.

Several seedlings were sent here for trial by Prof. Jas. Cassidy, but this

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one only seems valuable. Thirty-six hills yielded twenty-four pounds. Slightly elongated and flattened. Skin light pink and eyes at the surface.

DAKOTA SEEDLING.—From J. A. Everitt & Co., Indianapolis, Ind.

One tuber cut to twelve pieces produced two pounds and five ounces of potatoes, none of which were marketable. In shape and color the product resembles the original tuber, but the size and yield are very small compared with what was expected from the appearance of the tuber received from Everitt & Co., as that was a large and fine looking potato.

Several varieties were planted upon a very poor soil east of the apple orchard and were so nearly a failure that no record was kept of the weights.

While some of the varieties did not return the seed, others gave a very fair crop under the circumstances, and may be mentioned here as worthy of trial.

Summit.—Tubers of good shape, medium size, with quite large eyes at the surface.

Thorburn.—Tubers regular, smooth, eyes small, of excellent quality, and under good conditions an early and productive variety.

Sutton.—Tubers of good size, skin red and with eyes well marked. It has a tendency to become constricted toward one end, forming a sort of neck.

PRINGLE'S HYBRIDIZED POTATOES.

In the spring of 1887, packets of seeds under the above name were received from the Department of Agriculture. The seeds were planted and the resulting tubers were divided into six sorts, according to their shape and color. These were planted in the spring of 1888, and from the product the following notes were taken:

No. 1.—Tubers long and red. Yield variable, some hills producing no tubers of marketable size, while from others several large tubers were obtained. Often slender, curved, or with one end prolonged into a neck. Many tubers, however, are quite symmetrical, and it is possible that another year's selections will furnish a valuable variety. Season late. A good keeper and of fair quality.

These seedlings were sent to a number of persons in different parts of the State that they might be tested under various conditions, and the following are some of the reports from those who tried seedling No. 1:

A. G. Gulley, South Haven: Ten tubers, cut to three-eye pieces, weighing 1 pound 6 ounces, yielded 61 pounds of fair potatoes.

D. S. Lincoln, Big Rapids: Twelve tubers, weighing 1 pound 6 ounces, produced 38 pounds, of which about half were merchantable. It is of fair quality and quite productive, but its color and shape are against it.

No. 2.—Round and red. Tubers more even in size; none very large, but with more of a marketable size than were furnished by No. 1. Eyes quite deep; quality good. It may prove valuable, especially upon a heavy soil. Season very late.

Report of F. E. Skeels, Grand Rapids: Planted 15 tubers of Pringle's No. 2, weighing 1½ pounds. Harvested 61 pounds, of which 24½ were merchantable. Size fair; quality good.

George Skene, Port Austin: Eleven tubers, No. 2, weighing 1 pound 5 ounces, yielding 10 pounds 4 ounces. Quality not good.

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PLATE I.

FIG. 1.—Burpee's Superior.

FIG. 2.—Early Oxford.

FIG. 3.—Rural New Yorker, No. 2.

FIG. 4.—New Queen.

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Nos. 3 and 4.—Color purple. Worthless.

No. 5.—Long and white. Several types were noticeable among these seedlings, the best being flattened, very smooth. Eyes even with the surface and hardly noticeable. Many of them perfect in form and of a large size. Flesh white and of the very best quality.

Only one report was received. George Skene reported from 1 pound and 6 ounces a product of 8 pounds and 13 ounces. Growth of vines strong. Tubers larger than the seed.

Thos. Brown, Grandville, Michigan: The vines were badly injured by the beetles, but No. 5 shows itself to be a good potato, while No. 6 is better, yielding equal to Beauty of Hebron.

No. 6.—Round and white. The types of this group were of good size and something the shape of a short, thick yam. Quite watery and of poor quality. This form also appeared occasionally in No. 5, while the bulk of No. 6 were long and flattened, and could very properly be classed in No. 5.

D. S. Lincoln, Big Rapids, reports: Nine tubers weighing 1 pound and 13 ounces produced 21 pounds, of which 9½ were merchantable.

II. KALE.

(*Brassica oleracea acephala.*)

A plant of the cabbage family extensively grown in Europe for the table, and as food for cattle. It produces a crown of leaves but does not form a head. As a vegetable it dates back more than two thousand years to the early days of Rome. It was also cultivated by the ancient Greeks.

Kales require the same care as cabbages, and can be used for the same purposes. The table varieties are preferred to cabbages, as they are hardier, and are also milder in flavor. They may be left in the field when the temperature does not get below zero, and can be used at any time during the winter.

A dwarf variety is often sown in the fall, wintered over the same as spinach and used for greens under the name of "sprouts" or "German greens." As food for stock the coarser varieties are much esteemed in France, but in this country, where corn and roots can be so cheaply grown, it will never be valued as an article of fodder.

Seeds of the following varieties were obtained from Vilmorin, Paris, and were planted and cared for the same as early cabbages. The French names given are those under which they were purchased:

DWARF GREEN CURLED KALE. CANADA KALE. (*Chou Frisé Vert á Pied Court.*)

Stem short and stout. The leaves, which rest upon the ground, are quite narrow and deeply lobed, and average fifteen inches in length. The sides and ends of the leaves are much curled and are often rolled underneath. The blades are green, while the veins are white in color. This variety is quite hardy and with slight protection will pass the winter out of doors. One of the best for culinary purposes.

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TALL GREEN CURLED KALE. TALL SCOTCH KALE. (*Chou Frisé Vert Grand.*)

A tall growing variety differing from the above form principally in length of stem and in the leaves being more plume like. Stem stout and straight, three or four feet high.

DWARF RED CURLED KALE. (*Chou Frisé Rouge á Pied Court.*) Fig. 5, Plate II.

Differs from Dwarf Green Kale only in having leaves with red veins and reddish green veins.

TALL RED CURLED KALE. (*Chou Rouge Frisé Grand.*)

Like the Dwarf Red except that it has a long stem like the Tall Green.

CUT LEAVED CURLED KALE. (*Chou Frisé Lacinié Panaché.*)

Similar to the Dwarf Red in color, but is slightly taller, being one and one-half to two feet in height. The edges of the leaves are very finely divided and the midribs and veins are marked with bright red.

CURLED WHITE VARIEGATED KALE. (*Chou Frisé Panaché Blanc.*)

Two and one-half feet high. Leafstalks and veins of a clear white color, which often spreads over half the blades of the newer leaves.

CURLED RED VARIEGATED KALE. (*Chou Frisé Panaché Rouge.*)

Differs from the last only in having red or pink midribs and veins, while the blades of the leaves are of a reddish green.

DOUBLE CURLED HALF DWARF GREEN KALE. (*Chou Extra Frisé Demi Nain Vert.*)

Much curled. Plant erect, two feet high. Leaves green, edges finely cut and moss curled. An excellent variety either for cooking or garnishing.

CURLED WINTER MOSBACH KALE. (*Chou Frisé d'Hiver de Mosbach.*)

Very much curled. Veins well marked with white. Borders of the leaves often of a light yellow.

CURLED WINTER KALE OF HALLÉ. (*Chou Frisé d'Hiver de la Hallé.*)

Much like the last, except that it is coarser and less finely curled.

RED MARROW KALE. (*Chou Moellier Rouge.*)

Three and one-half feet high, slim, stout, often swollen to three and four inches in diameter, and filled with a cellular pith; leaves large, lobed at the base and scattered along the stem. The plants are rather tender; largely used in France for stock feeding.

WHITE MARROW KALE. (*Chou Moellier Blanc.*)

Differs from the last in having white stalks and veins.

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PLATE II.

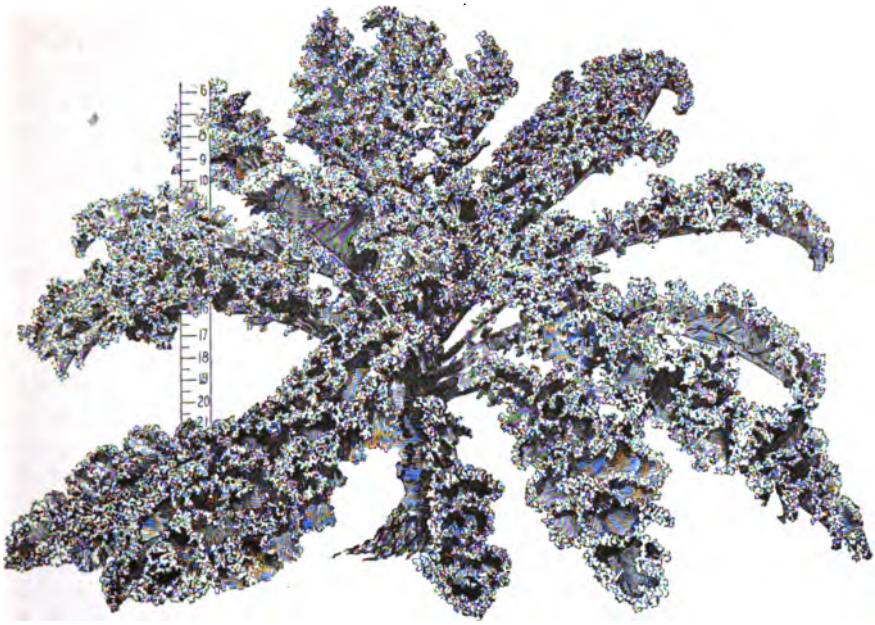

FIG. 5.—Dwarf Red Curled Kale.

FIG. 6.—Fruit resulting from Crookneck × Bush Scallop.

FIG. 7.—Produced from seeds taken from squash shown in Fig. 6.

FIG. 8.—Squash No. 8 (a), 1887.

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RED FLANDERS KALE. (*Chou Caulet de Flanders.*)

One of the hardiest varieties; leaves rather small for this class, with the borders sinuate and undulating. Stems and vines light red, and the former becoming slightly branching by throwing up suckers from the axils of the leaves.

RED JERSEY CAVALIER KALE. (*Chou Cavalier Rouge de l'Artois.*)

Plants quite large and tree-like in appearance. The variety owes its name of *Cavalier* to the fact that when full grown it is as high as a man on horseback. The stem is straight, comparatively slender, and without axillary shoots; in color, the stem and leaf stalks are pinkish red.

ANGERS KALE. (*Chou Branchu de Poiton.*)

Not quite as tall as the Flanders Kale, which it resembles in appearance, except that it has white leaf veins. Leaves generally larger and with longer and more slender stalks than that variety.

THOUSAND HEADED KALE. (*Chou Mille Têtes.*)

In habit of growth this is similar to the Angers Kale, but it is more branching, while the leaves are quite large and more numerous. The least hardy of any of the varieties.

PALM KALE. (*Chou Palmier.*)

Leaves narrow, dark green in color, much crinkled, and in shape and size resembling tobacco leaves. The first year it only attains the height of two or three feet, but when three years old it is said to be seven or eight feet high. It is only valued as an ornament.

COW CABBAGE. (*Chou Cavalier Chou a Vache.*)

A forage kale, intermediate between Chou Branchu du Poiton and Mille Têtes.

LARGE LEAVED STOCK KALE. (*Chou Fourrager de la Sarthe, a tres Large Feuille.*)

Stem stout; leaves very large and broad, much like the lower leaves of cabbage. The plants reach a height of two and one-half feet the first year and furnish a large amount of fodder for stock.

III. CROSS FERTILIZATION OF SQUASHES.

The question as to whether the effect of a cross is confined to the ovules (seeds) the first year, or extends to the ovary and receptacle, has earnest advocates upon both sides.

Hoping to learn something regarding the matter, in 1887 Prof. Bailey artificially fertilized the pistils of Yellow Crookneck squash vines with pollen from the stamens of White Bush plants. From these plants four fruits were obtained, which did not differ in appearance from true Crooknecks (Fig. 6, Plate II), indicating that the effect in squashes, at least, was confined to the seeds.

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Seeds from two of these fruits were planted last spring, and the fruits produced showed conclusive evidence of their parentage. They were in all cases white like the male parent, but were also covered with warts, which are so noticeable in the Crooknecks. While some of them had necks that were slightly developed, most of them were flattened and with deep scallops similar to those of the White Bush. (Fig. 7, Plate II.) The effect of the White Bush seemed most potent. Some of the seeds were planted on muck and others upon sandy soil. The effect of the soil upon the character of the fruit was quite noticeable, as the fruit grown upon light soil had much shallower creases, and fewer warts than those grown upon muck.

Another experiment has given some very interesting results. Seeds of Crooknecks, Bush, and other varieties of squashes were planted near together and allowed to cross fertilize but no effect of crossing could be detected in the fruit as no effect was noticeable in the fruits upon any one vine. Twenty-three typical fruits were selected, photographed, and the seeds removed. Last spring the seeds were planted, and, as might be expected, there was great variation in the fruits, upon different vines, although the fruits upon any one vine were identical. To show the effect of the cross, the notes upon one of the squashes are here inserted.

Squash No. 8 (a)—Fruit from Crookneck seeds planted in the spring of 1887. Length 5½ inches, greater diameter 4½ inches, very warty, irregularly ridged. (Fig. 8, Plate II.)

Squash No. 8 (b)—Seeds were selected from the above squash No. 8 (a), planted in the spring of 1888, and the following fruits (Fig. 9, Plate III) were raised from different vines.

1. Orange, very warty, and irregularly ridged.
2. Dark green, with a few yellow spots near blossom end, warts numerous but small, not ridged.
3. Dark green, a few yellowish spots on one side, nearly smooth, warts few and small, ridges inconspicuous.
4. Greenish white, with dark green stripes between scallops running from stem to blossom. The body color spotted with the same shade of dark green, a few small warts, regularly scalloped. Flattened.
5. Cream color, warts few, regularly and deeply scalloped. Flattened like Bush scallop.
6. Cream color, very warty, irregularly and but slightly scalloped.

The differences in the other twenty-two cases were nearly as marked as in those mentioned. And, especially as the results coincide with those obtained by others, the only conclusion that can be reached is that, under normal conditions, the effect of a cross upon the squash is confined to the seeds. This test with one plant is of course not sufficient to warrant the statement that the same rule holds true for all plants, but, although many cases are instanced where the pollen affects the receptacle, yet no investigators, while working upon this subject, have been able to produce fruits in which the ovary walls or receptacle were affected by the pollen used.

IV. TOMATOES.

In the test of tomatoes the same course was pursued as last year, and with the exception of Nos. 170 to 177 the seed used was saved by the department, so that from most of the varieties three crops of fruit have been secured since the seed was originally obtained from the seedsmen.

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PLATE III.

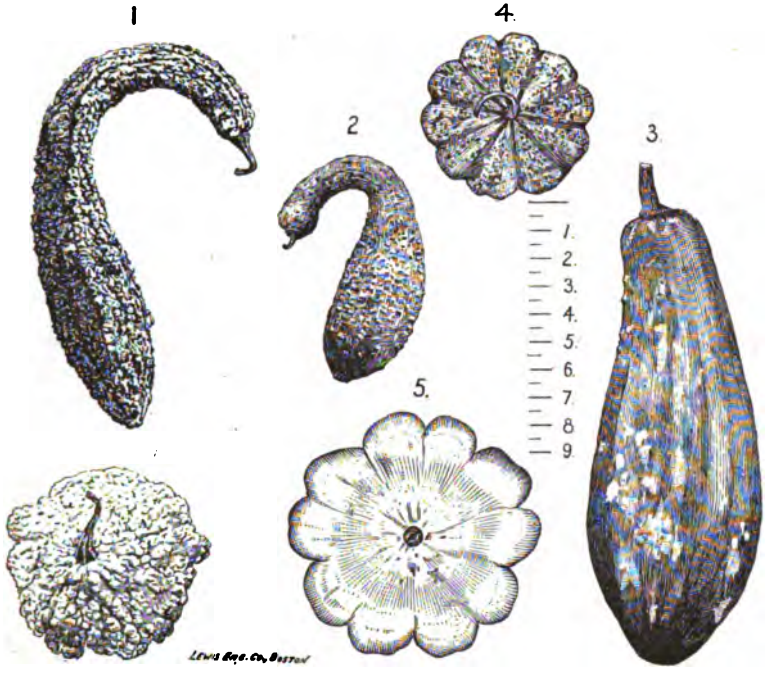

FIG. 9.—Squash No. 8 (b), 1888.

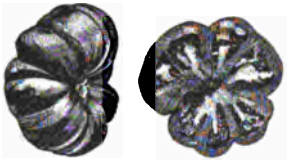

FIG. 10.—Early Dwarf Red.

FIG. 11.—Extra Early Cluster.

FIG. 12.—Queen.

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The collection embraces all of the leading varieties advertised by the dealers, and, as many of them were offered under different names or as special strains, it contained one hundred and forty-eight varieties. This was still further increased by the fact that fifty-two of these varieties were also grown from seeds saved from the first ripe fruits, making a total of two hundred varieties or numbers.

The seeds were sown in the forcing house on the 15th of March, and a record was made of the per cent of germination. After being transplanted, six plants of each kind were placed in the garden as soon as danger of frost was over. They were planted five feet apart each way and, despite the dry weather, soon covered the ground, making it difficult to gather the fruit without injuring the vines.

The first ripe fruits were noticed on the 15th of August, and the first picking was made on the 17th. The ripe fruits of each variety were counted and weighed, and the gathering was repeated, at frequent intervals, until the 15th of September, when all of the fruits upon the vines were picked, weighed and counted. The plants were also pulled and weighed.

Typical fruits were selected and photographed and the seeds which they contained were saved for next year's planting.

In the following synopsis of the varieties an attempt has been made to group together not only the varieties which are undoubted synonyms, but all those whose habit of growth, time of ripening, productiveness, and the size, color, and other characters of the fruits do not offer ready means of separation.

Although the number of varieties is not reduced by this, the difficulty of selecting varieties for planting is greatly decreased, as the gardener need only consider the groups instead of taking into account the dozen or more varieties of which the group may be made up.

CONCLUSIONS.

The following resumé is given for the benefit of those who do not have the time for an extended study of the table.

Varieties Recommended for Planting:

For pickling and preserving, any of the pear and plum varieties will be found desirable. The Green Gage and White Apple also answer well for this purpose. Of the yellow, apple shaped varieties Jaune Grosse Lisse Vil. proved most satisfactory. Golden Queen or Yellow Jefferson will also be found desirable.

The angular sorts are often recommended on account of their earliness, but, although many of them reach a large size and are very productive, several of the smooth sorts possess these characteristics in an equal degree, and are therefore preferable. If any of the angular sorts are to be grown, Extra Early or Cluster, Lan.,* will perhaps give best satisfaction.

For ordinary table and cooking purposes the chief dependence should be placed on the apple shaped sorts. A selection made up of the Advance or Hathaway's Excelsior, for early, and of almost any found in the Cardinal, Paragon, or Perfection groups, for the main crop, will answer every purpose either for home use or market.

* Lan. Neu., etc., after the name of a variety, merely indicates that the seed was obtained from Landreth, Neuman, etc.

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All of the new varieties grown for the first time this year seem valuable and well worthy of cultivation.

Of these varieties Glen Cove, *Burpee*, Bay State, *Rawson*, Volunteer, *Hallock*, and Americus Hybrid, *Faust*, are much alike and are fine, large tomatoes.

The Americus averages a trifle larger than the others, and was the earliest; Volunteer was a little later but was more productive.

Among the older varieties the Ignotum deserves special mention. This tomato was obtained as a sport from Eiformige Dauer. This year it exhibited some tendency to revert, but it furnished us the largest and finest fruits we had. They were thick, solid and quite smooth. One of the earliest to ripen, the plants remained vigorous throughout the season, notwithstanding the dry weather, and still bore a number of green fruits when killed by the frost. The variety was tested by quite a number of specialists and without exception they spoke favorably of it. Prof. Goff, of the N. Y. Experiment Station, writes: "Although the fruits were not very uniform, some were as fine as anything in the shape of a tomato I have ever seen; of good size, remarkably solid and perfectly smooth. With a few seasons' selection it will doubtless be unsurpassed."

Mr. A. I. Root, Medina, Ohio, speaks in equally high terms of it.

Effect of Using Seeds from First Ripe Fruits.

Fifty-two varieties were planted in duplicate, six plants being grown from seeds of the first ripe fruits of 1887, and the six adjoining hills from seeds selected some two weeks later.

The result as affecting the individual varieties is shown by the table, those grown from the first ripe fruits being designated "a."

Compiling the weight of the fruits grown from these varieties it was found that the seeds of the first ripe fruits produced at the first picking, 35¾ pounds of ripe fruit, while the other plants gave only 28½ pounds, showing a gain of 7¼ pounds in favor of planting seeds of the first ripe fruits, or 25 per cent.

Examining these figures it was found that the angular sorts, which naturally ripen early, produced 26 9-16 pounds at the first picking from the first ripe fruits, while only 6 11-16 pounds were produced by the late fruits, or only one-fourth as many. With the apple shaped sorts the result was reversed, as the yield was respectively 8 3-16 pounds and 21 7-16 pounds for the seeds from the first and the late ripening fruits, or in other words the first picking of tomatoes of angular varieties gave four times as many fruits from plants grown from seeds of the first ripe fruits as from those selected from the main crop, while with the apple shaped sorts only two-fifths as many were obtained.

SYNOPSIS OF THE VARIETIES GROWN IN 1888.

I. LYCOPERSICUM PIMPINELLIFOLIUM. Dunal.

Plants slender and spreading. Leaflets round ovate, generally obtuse, entire, small.

1. *Currant.* Thorburn. (*Rothe Johannesbeerfruchten*, Neuman.) (Fig. 13, Plate IV.) Fruit two-celled, light red, round, and about half an inch in diameter. Too small to be of any value

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PLATE IV.

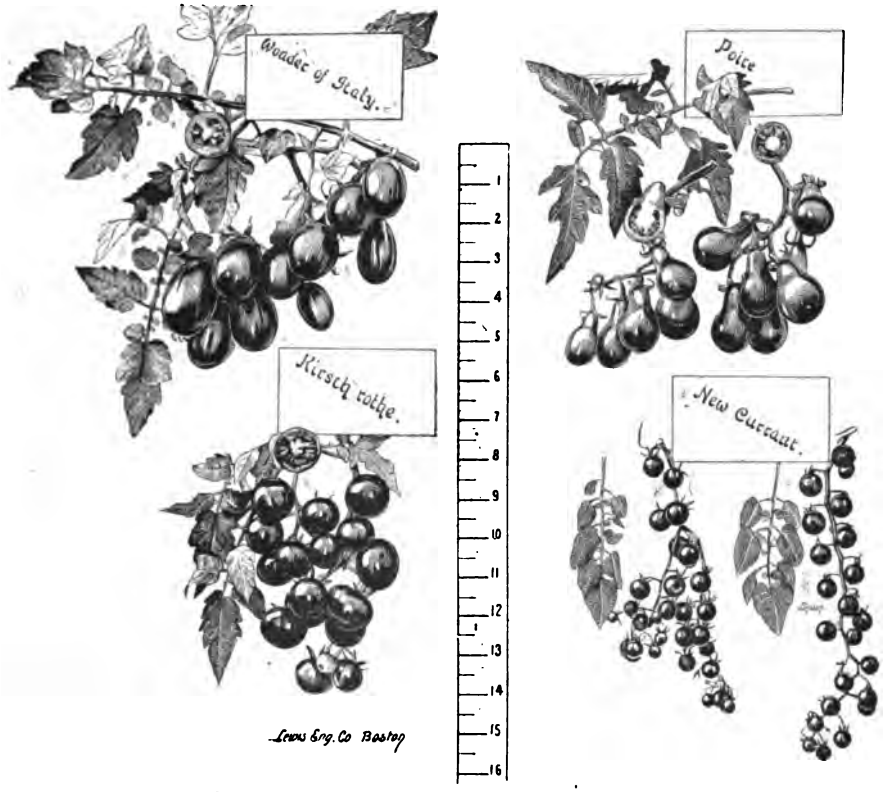

FIG. 13.—Currant, Cherry, Pear, and Plum Tomatoes.

FIG. 14.—Scoville.

FIG. 15.—Advance.

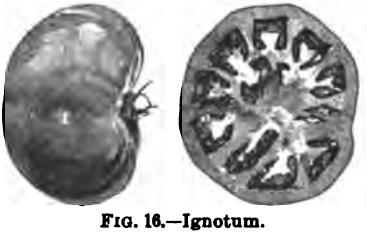

FIG. 16.—Ignotum.

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II. LYCOPERSICUM ESCULENTUM.

A. CERASIFORME.—Cherry Tomatoes. Plants slender, recumbent. Fruit round, smooth and two-celled.

2. *Red Cherry,* Henderson. (*Cerise,* Vilmorin; *Kirsch rothe,* Neuman.) (Fig. 13, Plate IV.) Greenish red to dark red. Average size three-fourths of an inch in diameter. The same difference in size was noticeable as appeared this year, the American seed producing fruits only half as large as those obtained from France and Germany. The fruits grown from the latter were often angular and contained three cells. Valuable only for pickles and preserves.

3. *Yellow Cherry,* Thor. (*Gelbe Kirsch,* Neuman.) Differs from Red Cherry in color only.

B. PYRIFORME.—Group 1. Pear-shaped. Plants vigorous, with quite large, deeply cut and slightly curled leaves. Fruits pear-shaped, with the necks generally well marked.

4. *Poire,* Vil. (*Queen of Tomatoes,* Dickson.) (Fig. 13, Plate IV.) Fruits average 1½ inches in length, and ¾ of an inch in diameter at the base. Distinctly pear-shaped, deep red.

5. *Nisbit's Victoria.* Slightly larger than the above, but greatly resembles it. Neck less distinct. Leaves large, but differing from those of Potato Leaf.

Group 2. Oblong Tomatoes.

6. *Wonder of Italy,* Burpee. (*Rothe Birne,* Neuman. *Pear-shaped,* Henderson. *Red Plum,* Hend.) (Fig. 13, Plate IV.) Fruits oblong, occasionally showing a slight neck, 1⅝ inches long by 1¼ inches broad. Generally two-celled, dark red, firm. The only difference in these varieties is that the Wonder of Italy averages slightly larger than the others.

7. *Yellow Plum.* Differs from the last only in color.

8. *King Humbert,* Vilmorin, Neuman, Dickson and Rawson. Fruits of this variety from seeds obtained from Vilmorin were but little larger than the Pear-shaped of Henderson, while those from Neuman, Dickson and Rawson averaged much larger, measuring 2½ inches long by 2 inches broad. Frequently slightly pear-shaped. Dark red, very productive, but the fruits, especially the large ones, are often hollow.

9. *Criterion.* Average fruits 2¼ by 2 inches. End abruptly flattened; slightly angular. Fruit resembles Acme in color, generally two-celled, but sometimes contains four or five cells and then measures 3 inches by 1½ deep.

C. VULGARE.—Plants strong and vigorous, foliage coarser and darker than in the last two groups. Fruits flattened or round, and with more than two cells.

Group 1. Fruits more or less angular. Fruits flattened, generally smooth on top, but deeply furrowed and corrugated around the edges and on the under side. Many of the varieties reach a large size and are early in ripening, but most of them are so irregular that they are of little or no value for cultivation.

10. *Orangefield.* Sibley. Fruits slightly corrugated, round or oval, 2½ by 3½ inches deep. Slight red, rather soft.

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11. *Eiformige Dauer,* Neu. Fruits small, seldom reaching a diameter of 2 inches, even in size and shape. Angles well marked. Quite firm and a long keeping variety. In color about like Orangefield.
12. *Hundred Days,* Thor. (*Hundert Tagige,* Neu. *Stamfordian,* Dick.) Plants rather small. Fruits measure 2 by 2½ inches, flattened, deeply ribbed, often curved and with a ring at the end. Foliage much curled.
13. *Large Red,* Dick. (*Early Richmond,* Landreth. *Cedar Hill,* Neu. *Franz gross rothe,* Neu.) Fruits and plants larger than the last, but identical in other respects. Dark red, marked slightly with yellow dots. Fruits measure 2½ by 4 inches and 1½ deep.
14. *Precursor,* Nellis. (*Conqueror.* Hend. Neu. *Bermuda Extra Early,* Land. *King of the Earlies,* Ely.) Much more regular and less angular than Large Red. Fruits 3 by 3½ inches, being nearer round than those of the Large Red type. The different strains of Conqueror vary in size and color. Ely's King of the Earlies is apparently a well selected Precursor, fruits even in size, thickly clustered. Although not as early as its introducer claims, its fruits are abundant, of good size and fairly smooth.
15. *Extra Early or Cluster,* Land. (*Jackson,* Dick. *Rouge Grosse,* Vil.) (Fig. 11, Plate III.) The best of the angular varieties, large, even in size and shape, generally 3 or 4 inches in diameter and quite deep. Sometimes distinctly angled, but many of the fruits are nearly as regular as Cardinal.
16. *Turk's Cap.* (*Turkenbund,* Neu.) Plants with slender branches. Fruits small, round, deeply ribbed, with a crown of irregular cells upon the center of the apex. Worthless.

The fruits in the next four groups have their leaves much more curled than the above kinds.

17. *Early Dwarf Red,* Dick. (*Rouge naine hative,* Vil. *Frühe rothe zwerg,* Neu. *Hubbard's Curled Leaf,* Nellis. *Kransblätter,* Neu. *Rouge gross hative,* Vil.) (Fig. 12) Fruits flattened, smaller than Large Red, 2½ to 3 inches long by 1 inch deep. All quite variable in form.
18. *Tom Thumb,* Rawson. Plants small. Leaves much curled. Fruits much like those of Hundred Days and Early Dwarf Red, but are smaller and more irregular.
19. *Keye's Early Prolific,* Neu. Fruit larger and smoother than Tom Thumb. Leaves quite large and much curled.
20. *Gestreifte,* (Striped.) Neu. Similar to Early Dwarf red except that the red fruits are striped and splashed with orange.

Group 2. The apple-shaped sorts:

* Fruit yellow or yellowish white.

21. *Green Gage,* Hend. Neu. Dick. Fruit small, seldom exceeding 1½ inches in diameter, deep yellow, nearly spherical from Henderson, while from Dickson and Neuman, as last year, it gave fruits much larger in size, some of them reaching two inches in diameter.

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22. *Large Yellow Improved,* Thorburn. Larger than any of the forms of Green Gage, averaging about 2½ inches in diameter, somewhat flattened.
23. *New White Apple,* Thor. (*Snowball,* Nellis. *Apfel Weisser,* Neu.) Fruit spherical 1½ inches in diameter, slightly flattened as grown from Prussian seeds. Rather soft, and nearly white in color.
24. *Golden Queen,* Rawson. (*Yellow Jefferson,* Leonard. *Sunset,* Tillinghast.) Larger and lighter in color than Large Yellow, often becoming slightly orange at the apex. Two and one-half inches in diameter, flattened, and sometimes slightly oblong, generally regular but occasionally corrugated.
25. *Yellow Victor,* Gregory. Dark yellow, much flattened, 3 inches in diameter. Often angular and irregular.
26. *Jaune Grosse lissè,* Vil. Large, smooth and deep, 3 inches in diameter. Color much like Yellow Victor, often becoming quite dark. The best of the large yellow varieties.
27. *Golden Trophy,* Rawson. In shape resembling the Red Trophy, but somewhat smaller; color light yellow, tinged with red.

** Fruit red.

28. *Little Gem,* small, flattened, 2 inches by 1¼ deep, regular and smooth.
29. *Cook's Favorite,* Greg. Fruit smooth, regular and round, nearly spherical, considerably larger than Little Gem, which it closely resembles in other respects. *Cook's Favorite,* Neuman, was nearly as angular as Early Dwarf Red. Evidently untrue.
30. *Boston Market,* Raw. (*Faultless,* Greg. *Fulton Market,* Greg., Neu. *Gen. Grant,* Hend., Neu. *Alpha,* Thor. *Canada Victor,* Hen.) Quite variable in form, some being smooth and regular, while others are angular and curved. Average fruits about 3 inches across by 1½ inches deep. Boston Market and Faultless are sometimes considerably marked with bronze. The above varieties very nearly approach Conqueror of the angular class.
31. *New York Market,* Nellis. Large, smoother and thicker, but less productive and later than Boston Market. Fruits are generally quite regular and measure 3½ inches across by 2 inches deep.
32. *Trophy,* Dickson, Neuman. (*Extra Selected Trophy.* Hend. *Arlington,* Greg. *Hackwood Park Prolific,* Dick.) The best specimens measured over 4 inches in breadth with a depth of nearly 2½, the larger ones becoming oblong, curved and sometimes quite irregular. Extra Selected Trophy seems to have a larger proportion of fruits, regular and symmetrical.
33. *Bronze Foliage Trophy,* Thorburn. Fruit similar to Trophy but nearly two weeks later. Stem and leaf veins marked with dull purple. Leaves darker green than those of Trophy.
34. *Cardinal,* Hend., Thor., Neu., Dick., Root. (*Queen,* Nellis. (Fig. 12, Plate III.) *Prize Belle,* Buist. *Market Champion,* Ford. *Champion,* Neu. *Red Valencia Cluster,* Thor.)

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Fruits large, four inches across by nearly two inches deep, somewhat flattened, and sometimes quite angular. Cavity broad and deeply furrowed. Light red with small yellow or golden spots.

35. *Perfection,* Hend. (*Optimus,* Ferry. *Scoville,* Perry. (Fig. 14, Plate IV.) *Autocrat,* Sibley. *Glatte Amerikan,* Neu.) Fruits medium to large, nearly spherical, smooth and regular. Cavity very small, and generally without furrows. Dark red.

36. *Mayflower,* Hend., Root, Neuman. (*Paragon,* Hend., Neu. *Ignotum,* College. (Fig. 16, Plate IV.) *Puritan,* Rawson. *Glen Cove,* Burpee. *Emery,* Rawson. *Bay State,* B. L. Bragg. *Volunteer,* V. H. Hallock. *New Red Apple,* Greg. *Livingston's Favorite,* Sib., Hend., Dick. *Americus Hybrid,* Faust. *New Jersey,* Land.) Less angular than those of the Cardinal class but more irregular, flattened, and larger than the Perfection.

37. *Hathaway's Excelsior,* Hend., Root, Dick., Vil. Fruits medium to small, seldom reaching 3 inches in diameter, quite deep, the smaller ones being nearly spherical. Light red, smooth and regular. One of the best early varieties.

38. *Advance.* (Extra Early Advance.) Ford, Burpee. (Fig. 15, Plate IV.) Fruits differ from Hathaway only in being smaller and earlier. Plants generally smaller but very productive.

*** Fruits pink or purple.

39. *Peach,* Land. Fruit spherical or slightly elongated. One and one-half inches in diameter; smooth and regular; of a pinkish red color, resembling a peach.

40. *Acme,* Dick., Vil., Neu., Liv. (*Rochester,* Sib. *Rochester Favorite, Livingston's Beauty,* Liv. *Climax,* Raw. *Hovey,* Thor.) Fruits generally large and smooth, resembling Perfection in shape, but of a pinkish purple color. An excellent variety for home use or local market, but its thin skin makes it too tender for shipment. Beauty is perhaps less flattened than Acme.

D. GRANDIFOLIUM. Tomatoes with large leaves. Plants large, vigorous, in habit like those of the last class. Leaves few and large, nearly entire.

41. *Mikado,* Hend. (Turner's Hybrid.) Fruit very large, flattened, often oblong, cavity deep, often much furrowed, basin generally distorted in the larger fruits. Quite early, and averaging the largest of any tomato grown. Color of Acme.

42. *Potato Leaf,* Mills, Livingston. In plant much like Mikado, but the fruit is much more regular and more flattened.

E. VALIDUM. Upright or Tree Tomatoes. Stems short and stout, being self-sustaining. Leaves dark green, much curled and netted.

43. *New French Upright,* Thor. (*Grenier mit aufrechten stämme,* Neu. *Rouge à tige roide de Laye,* Vil. Fruits large and quite late, generally very irregular, basin deeply furrowed,

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and cavity often fissured, with projecting cells. Not productive.

42. *Station*, N. Y. Ex. Station. Derived from a cross of Alpha on French Upright. Plant much like the last, generally smaller. Fruit smaller and generally quite regular, but without value.

43. *Dwarf Champion*, Hend. A half dwarf variety. Branches short and stout, but not quite self-supporting. Leaves quite dark and much curled, something like those of the Upright varieties. Fruits resemble Acme in color, but are considerably smaller, quite smooth and with firm flesh. Yield (12 pounds per plant) considerably under the average; time of ripening medium.

Aside from the smoothness and quality of the fruit, about the only good things that can be said of this variety, *judging from one year's trial*, are that owing to its dwarf habits the plants can be planted much closer than other varieties, and that trellising may better be dispensed with.

As indicated by the opening sentence of the bulletin, this work was begun and carried on for the first of the season by Prof. Bailey, to whom credit should be given. The notes upon the squash, the comparative table, and the photographs of the different varieties, were made by my assistant, Mr. C. S. Crandall, to whom I am indebted for assistance in carrying out the details of the work.

L. R. TAFT,
Prof. of Horticulture and Landscape Gardening.

MICHIGAN AGRICULTURAL COLLEGE,
April 1, 1889.

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COMPARATIVE TABLE.

Name and Number of Variety. (Concluded on next page.)		Aug. 17.		Aug. 20.		Aug. 22.		Aug. 25.		Aug. 27.		Aug. 30.		Sept. 3.		Sept. 4.		Sept. 6.		Sept. 8.	
		No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.
Tom Thumb, Rawson	No. 1	.....	.....	.....	.....	.....	.....	2	4	.....	.....	6	12	28	84	.....	.....	63	142	.....	.....
" " "	1 a*	6	13	1	1⅛	3	3	2	4	.....	.....	36	68	49	90⅛	.....	.....	72	143	.....	.....
Hubbard's Curled Leaf, Nellis	2	.....	.....	.....	.....	1	1	5	11	.....	.....	76	199	29	83	.....	.....	62	131⅛	.....	.....
" " " "	2 a	4	7⅛	1	⅛	2	2	6	14	.....	.....	29	88	34	103	.....	.....	74	188	.....	.....
Krausblatter, Neuman	3 a	9	21	7	16	1	2	12	27	.....	.....	58	153	90	242	.....	.....	116	330	.....	.....
Precursor, Nellis	4	.....	.....	.....	.....	.....	.....	3	6	.....	.....	27	109	34	178⅛	.....	.....	47	204	.....	.....
" "	4 a	2	5	.....	.....	2	6	4	10	.....	.....	16	53	37	165⅛	.....	.....	67	258	.....	.....
Orangefield, Sibley	5 a	1	2	1	2	2	5	19	58	.....	.....	59	222	84	352⅛	.....	.....	.....	.....	108	397
Hundred Day, Thorburn	6	.....	.....	1	3⅛	2	4	9	21	.....	.....	29	73	51	120⅛	.....	.....	.....	.....	120	280
" " " "	6 a	13	26	10	25	2	3	24	50	.....	.....	110	226	146	312	.....	.....	.....	.....	255	510
Hundert Tagige, Neuman	7 a	9	12	9	22	3	3	21	36	.....	.....	94	187	115	235⅛	.....	.....	203	389	.....	.....
Conqueror, Henderson	8 a	3	8	7	15	.....	.....	21	36	.....	.....	80	212	129	334½	.....	.....	128	296	.....	.....
" Dickson	10	.....	.....	2	4	.....	.....	3	9	.....	.....	33	80	87	242	.....	.....	77	236	.....	.....
" " "	10 a	9	23	2	7	1	2	8	24	.....	.....	44	152	127	429	.....	.....	82	258	.....	.....
Large Red, Dickson	11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13	70	33	150⅛	.....	.....	26	116	.....	.....
" " "	11 a	5	13	2	5	4	8	5	12	.....	.....	32	100	87	450⅛	.....	.....	.....	.....	90	374
Early Dwarf Red, Dickson	12	4	13	2	7	.....	.....	1	7	.....	.....	17	65	53	174	.....	.....	.....	.....	56	198
" " " "	12 a	13	26	1	3	1	2	7	12	.....	.....	33	80	77	193	.....	.....	.....	.....	105	254
Early Richmond, Landreth	13	.....	.....	.....	.....	.....	.....	4	17	.....	.....	15	71	40	220	.....	.....	.....	.....	68	317
" " "	13 a	5	15	6	14	9	32	17	65	.....	.....	65	261	144	637⅛	.....	.....	.....	.....	135	642
Bermuda Extra Early, Landreth	14	5	16	1	3	1	2⅛	6	21	.....	.....	45	173	73	292	.....	.....	111	369	.....	.....
" " "	14 a	1	4	1	3	.....	.....	1	4	.....	.....	3	13	5	20⅛	.....	.....	28	87	.....	.....
New Jersey, Landreth	15	5	28	1	7	.....	.....	9	50	.....	.....	14	28	50	219	.....	.....	88	337	.....	.....
" " Thorburn	16	1	7	.....	.....	1	9	4	15	.....	.....	4	26	5	36⅛	.....	.....	24	150	.....	.....
Key's Early Prolific, Neuman	17	6	16	1	6	3	7	13	35	18	48	59	137	86	202	.....	.....	99	240	.....	.....
" " " "	17 a	24	62	5	10	1	1⅛	8	22	.....	.....	66	143	89	232	.....	.....	113	296	.....	.....
Turkenbund, Neuman	18	.....	.....	2	2	1	1	2	2	.....	.....	37	48	44	75⅛	.....	.....	.....	.....	84	105
" "	18 a	2	3	.....	.....	1	1	6	8	.....	.....	22	36	35	37	.....	.....	.....	.....	129	160
Boston Market, Rawson	19	.....	.....	1	4⅛	1	1	8	29	.....	.....	32	104	66	242	.....	.....	.....	.....	60	202
" " "	19 a	17	41	1	3	2	4	9	21	.....	.....	62	208	124	414	.....	.....	.....	.....	152	533
Fulton Market, Gregory	20	5	13	6	16	5	23	8	37	.....	.....	75	205	111	350	.....	.....	.....	.....	138	468
" " "	20 a	7	18	2	4	10	36	9	32	.....	.....	63	199	116	338	.....	.....	.....	.....	148	413
" " Neuman	21 a	2	9	1	3	11	27	5	14	.....	.....	46	139	91	333	.....	.....	.....	.....	116	357
General Grant, Henderson	22	2	8⅛	4	14	7	20	24	81	22	78	72	275	112	418	.....	.....	.....	.....	76	310
" " "	22 a	4	12	7	23	17	53	24	64	40	107	63	206	71	250	.....	.....	.....	.....	67	248
" " Neuman	23 a	12	38	7	19	3	14	10	28	.....	.....	57	168	76	243	.....	.....	.....	.....	114	421
Alpha, Thorburn	24 a	.....	.....	3	11	4	13	7	24	.....	.....	43	152	107	414	.....	.....	.....	.....	132	526
Faultless, Gregory	25	9	25	2	4	.....	.....	2	3	.....	.....	20	80	97	318	.....	.....	.....	.....	135	490
" "	25 a	2	6	3	3	.....	.....	5	19	.....	.....	15	57	68	318	.....	.....	.....	.....	87	374
Arlington, "	26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	4	.....	.....	5	26	.....	.....	16	166
Cook's Favorite, Gregory	27 a	3	4	1	2	.....	.....	4	9	.....	.....	13	22	40	77⅛	.....	.....	.....	.....	77	237
" " Neuman	28 a	4	7	.....	.....	2	2⅛	4	8	.....	.....	49	96	62	163	.....	.....	.....	.....	93	221
New York Market, Nellis	29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	26	16	93	.....	.....	.....	.....	19	98⅛

* "a" Grown from first ripe fruits of 1888.

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COMPARATIVE TABLE.—CONTINUED.

Name and Number of Variety. (Concluded from last page.)	Sept. 10.		Sept. 12.		Sept. 15.		Sept. 17.		Sept. 18.		Average weight of plants, oz.	Average number of fruits to a plant.	Average weight of fruits on a plant, oz.	Average weight of a fruit in oz.	Ratio of weight of fruit to weight of plant.	Number of days in germinating.	Per cent.
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.							
Tom Thumb, Rawson.....No. 1	28	74	66	124	480	460	.....	.....	.....	.....	52	168 1-4	225	1.337	4.326	10	48
" " " ..... 1 a	66	126	80	120	735	704	.....	.....	.....	.....	52	175	212 1-6	1.212	4.08	9	76
Hubbard's Curled Leaf, Nellis.. 2	50	116	56	120	529	792	.....	.....	.....	.....	54 2-3	133	242 1-4	1.821	4.431	10	50
" " " " " .. 2 a	63	154	50	98	601	839	.....	.....	.....	.....	60	144	260 2-3	1.810	4.344	10	36
Krausblatter, Neuman..... 3 a	104	325	114	252	691	1,032	.....	.....	.....	.....	70 2-3	200 1-3	400	2.	5.66	10	76
Precursor, Nellis..... 4	47	237	48	216	364	764	.....	.....	.....	.....	76	95	285 3-4	3.	3.76	9	56
" " ..... 4 a	78	343	61	196	572	952	.....	.....	.....	.....	92	139 5-6	331 5-12	2.37	3.602	10	48
Orangefield, Sibley..... 5 a	----	-----	60	252	568	800	.....	.....	.....	.....	71 1-3	150 1-3	348 5-12	2.37	4.884	9	68
Hundred Day, Thorburn..... 6	----	-----	150	392	762	1,240	.....	.....	.....	.....	45 1-3	187 1-3	359	1.916	7.919	10	92
" " " " ..... 6 a	----	-----	216	464	574	836	.....	.....	.....	.....	48	192 6-7	350 2-7	1.816	7.297	10	56
Hundert Tagige, Neuman..... 7 a	89	216	59	227½	165	377	.....	.....	.....	.....	45 1-3	127 5-6	279 1-2	2.186	6.165	11	58
Conqueror, Henderson..... 8 a	53	132	81	128	192	284	.....	.....	.....	.....	53 1-3	115 2-3	237 7-12	2.054	4.454	11	60
" Dickson..... 10	67	204	69	152	460	950	.....	.....	.....	.....	91 1-5	159 3-5	375 2-5	2.352	4.116	9	52
" " ..... 10 a	48	216	63	180	528	1,163	.....	.....	.....	.....	96 2-3	152	409	2.69	4.231	9	58
Large Red, " 11	41	186	20	92	502	1,352	.....	.....	.....	.....	88 2-3	105 2-3	327 3-4	3.101	3.696	9	52
" " ..... 11 a	----	-----	183	600	.....	.....	728	1,164	.....	.....	127 2-3	189 1-3	454 5-12	2.4	3.559	9	80
Early Dwarf Red, Dickson..... 12	----	-----	74	180	.....	.....	874	1,208	.....	.....	82	180 1-6	308 2-3	1.713	3.764	9	72
" " " " ..... 12 a	----	-----	159	312	.....	.....	898	1,040	.....	.....	81 1-3	215 2-3	320 1-6	1.484	3.936	9	48
Early Richmond, Landreth..... 13	----	-----	48	240	.....	.....	442	780	.....	.....	60	102 5-6	274 1-6	2.666	4.569	8	60
" " ..... 13 a	----	-----	114	520	.....	.....	794	1,167	.....	.....	119 3-7	184 1-7	479 1-14	2.60	4.011	9	76
Bermuda Extra Early, Landreth 14	64	200	124	268½	431	768	.....	.....	.....	.....	79 1-3	143 1-2	342 1-6	2.384	4.313	8	68
" " " ..... 14 a	62	245	87	196	636	1,079	.....	.....	.....	.....	112	129	265 1-4	2.056	2.368	10	32
New Jersey, Landreth..... 15	54	269	47	176	455	1,183	.....	.....	.....	.....	42 2-3	120 1-2	382 5-6	3.177	8.978	10	68
" " Thorburn..... 16	23	168	28	200	550	1,308	.....	.....	.....	.....	142 2-3	106 2-3	319 11-12	3.	2.241	8	70
Key's Early Prolific, Neuman... 17	81	217	97	200	714	1,000	.....	.....	.....	.....	99 1-3	196 1-6	351 1-3	1.79	3.557	10	88
" " " " ... 17 a	88	241	116	280	700	997	.....	.....	.....	.....	112 4-5	242	453 9-10	1.871	4.015	10	20
Turkenbund, Neuman..... 18	----	-----	127	136	2,524	1,133½	.....	.....	.....	.....	164	470 1-6	250 1-2	.532	1.527	8	84
" " ..... 18 a	----	-----	197	176	2,800	1,260	.....	.....	.....	.....	26 2-3	532	280 1-6	.526	1.355	8	92
Boston Market, Rawson..... 19	----	-----	166	564	.....	.....	753	1,708	.....	.....	94 2-3	181 1-6	490 3-4	2.708	5.184	9	74
" " " ..... 19 a	----	-----	116	664	.....	.....	.....	.....	956	1,734	112 6-7	215 4-9	517 3-7	2.4	4.585	10	18
Fulton Market, Gregory..... 20	----	-----	91	256	.....	.....	462	764	.....	.....	99 1-3	150 1-6	353 1-2	2.354	3.558	8	66
" " " ..... 20 a	----	-----	96	240	.....	.....	252	903⅓	.....	.....	86	117 1-6	363 11-12	3.106	4.231	10	34
" " Neuman..... 21 a	----	-----	107	304	.....	.....	378	536	.....	.....	86	126 1-6	295 1-6	2.26	3.315	10	52
General Grant, Henderson..... 22	----	-----	87	304	.....	.....	366	412	.....	.....	121 3-5	154 2-5	384 1-10	2.487	3.158	8	44
" " " ..... 22 a	----	-----	83	260	.....	.....	417	468⅓	.....	.....	123	132 1-6	281 11-12	2.133	2.292	9	44
" " Neuman..... 23 a	----	-----	122	400	.....	.....	400	636⅓	.....	.....	104 2-3	133 1-2	327 3-4	2.455	3.131	9	68
Alpha, Thorburn..... 24 a	----	-----	161	608	.....	.....	292	452	.....	.....	88 2-3	124 5-6	366 2-3	2.937	4.135	9	20
Faultless, Gregory..... 25	----	-----	255	845	.....	.....	787	1,282	.....	.....	125	217 5-6	502 5-6	2.308	4.022	8	46
" " ..... 25 a	----	-----	67	240	.....	.....	284	691⅓	.....	.....	73 3-5	106 1-5	341 7-10	3.217	4.642	10	42
Arlington, " 26	----	-----	38	315	.....	.....	.....	.....	212	196	158 2-3	45 1-3	117 5-6	2.6	.742	8	48
Cook's Favorite, Gregory..... 27 a	----	-----	146	240	.....	.....	.....	.....	984	955⅓	113 3-5	253 3-5	309 2-5	1.22	2.723	10	48
" " Neuman..... 28 a	----	-----	103	240	.....	.....	.....	.....	285	356	143 2-3	100 1-3	132 1-12	1.814	1.267	10	80
New York Market, Nellis..... 29	----	-----	24	128	.....	.....	.....	.....	420	894	163 3-5	97	247 9-10	2.555	1.515	8	68

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COMPARATIVE TABLE.—CONTINUED.

Name and Number of Variety. (Concluded on next page.)	Aug. 17.		Aug. 20.		Aug. 22.		Aug. 25.		Aug. 30.		Aug. 31.		Sept. 3.		Sept. 4.		Sept. 8.		Sept. 12.	
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.
Victor, Neuman.....No. 32 a	15	41	1	2½	1	2	10	34	54	174	.....	.....	72	250	.....	.....	108	378	95	330
Ex. Selected Trophy, Henderson. 35	.....	.....	.....	.....	.....	.....	2	12	8	31	.....	.....	24	122	.....	.....	42	214	41	216
Trophy, Dickson..... 37	.....	.....	.....	.....	1	3	2	10	6	23	.....	.....	36	151	.....	.....	66	326	42	176
" Neuman..... 38	2	7	.....	.....	.....	.....	.....	.....	7	38	.....	.....	.....	.....	31	209	37	258	61	460
" " ..... 38 a	7	25	.....	.....	4	11	9	23	6	23	.....	.....	.....	.....	64	217	71	258	201	605
Read's Island Beauty, Thorburn 40 a	.....	.....	2	2	7	6	3	3	16	18	.....	.....	.....	.....	84	95	95	47	105	116
Bronze Foliage Trophy, " 41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	59	6	40
Queen, Nellis..... 42	7	25	4	13	9	34	4	13	17	50	.....	.....	.....	.....	62	249	78	317	108	392
" ..... 42 a	1	5	8	19	3	10	1	5	7	22	.....	.....	.....	.....	20	121	43	225	125	764
Cardinal, Henderson..... 44	4	7	1	1	.....	.....	.....	.....	4	19	.....	.....	.....	.....	32	123½	45	185	86	342
" " ..... 44 a	2	5	1	1	1	2½	4	11	4	14½	.....	.....	.....	.....	32	118	37	157	141	550
" Thorburn..... 46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	2	.....	.....	3	25	4	20	19	92
" Neuman..... 47	.....	.....	2	4	.....	.....	.....	.....	.....	.....	5	22	.....	.....	12	54	26	150	99	208
" Dickson..... 48 a	2	5	.....	.....	.....	.....	1	3	.....	.....	5	14	.....	.....	7	32	8	43	211	667
" Root..... 49	3	31	3	5	.....	.....	2	8	.....	.....	6	33	.....	.....	11	55¼	43	234	87	465
" " ..... 49 a	3	13	1	6	3	11	1	2	20	43	.....	.....	.....	.....	71	163	30	74	100	191
Prize Belle, Buist..... 50 a	.....	.....	.....	.....	7	12½	.....	.....	10	35	.....	.....	.....	.....	38	215	28	158	127	784
Red Valencia Cluster, Thorburn 51	3	11	.....	.....	3	7	1	4	5	19½	.....	.....	.....	.....	32	103	34	166	70	329
" " " 51 a	.....	.....	.....	.....	.....	.....	3	12	2	13	.....	.....	.....	.....	8	50	11	61	119	417
Livingston's Favorite, Sibley... 52 a	9	41	.....	.....	.....	.....	.....	.....	.....	.....	9	41¼	.....	.....	23	135	82	288	69	364
" " Henderson 53	1	6	.....	.....	1	2	1	2	.....	.....	24	73½	.....	.....	34	157	47	202	99	476
" " Dickson... 54	2	6	.....	.....	.....	.....	.....	.....	.....	.....	9	39	.....	.....	9	44	17	94	66	342
Market Champion, Ford..... 55 a	3	23	.....	.....	2	8	.....	.....	.....	.....	17	63¼	.....	.....	44	141	74	230	114	396
Champion, Neuman..... 56 a	3	12	1	2	1	4	1	3	.....	.....	29	167½	.....	.....	50	306	62	376	126	452
Hathaway's Excelsior, Hend..... 58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18	65	.....	.....	57	191	81	206	184	683
" " " ..... 58 a	2	2½	.....	.....	7	18	3	9	.....	.....	15	38½	.....	.....	83	241	62	198	71	336
" " Root..... 59 a	20	51	5	16	6	15½	6	18	.....	.....	40	147½	.....	.....	84	285	66	200	133	473
" " Dickson. 60 a	6	20	.....	.....	.....	.....	3	9	.....	.....	15	44	.....	.....	40	141	49	190	98	330
" " Vilmorin 61	2	5	.....	.....	2	9	1	3	.....	.....	7	18½	.....	.....	33	133	24	110	64	236
New Red Apple, Gregory..... 63	.....	.....	.....	.....	1	3	.....	.....	.....	.....	13	60	.....	.....	40	177	27	137	44	199
" " " ..... 63 a	5	21	1	5	2	4	1	4	.....	.....	27	101½	.....	.....	61	309	41	214	92	485
Advance, Ford..... 65	36	76	.....	.....	6	16	13	32	.....	.....	60	120½	.....	.....	160	391	88	246	218	616
" " ..... 66 a	16	35	4	8	2	4	3	9	.....	.....	30	68	.....	.....	82	209	.....	.....	.....	.....
Extra Early Advance, Burpee... 67	11	19	.....	.....	9	30	15	35	.....	.....	52	117½	.....	.....	86	199	160	392	.....	.....
" " " ... 67 a	3	3	4	8	2	5	14	27	.....	.....	64	152½	.....	.....	194	474	13	36	.....	.....
Perfection, Henderson..... 68	4	16	.....	.....	1	3½	1	4	.....	.....	5	16	.....	.....	33	111	74	254	.....	.....
Paragon, Henderson..... 71	31	83	5	10	6	17	14	45	.....	.....	48	165½	.....	.....	75	249	104	306	.....	.....
" Neuman..... 72	7	26	3	13	2	10	1	7	.....	.....	1	2	.....	.....	4	26½	11	126	.....	.....
" " ..... 72 a	.....	.....	6	13	.....	.....	.....	.....	.....	.....	4	18½	.....	.....	1	2	33	126	.....	.....
Emery, Rawson..... 73 a	5	14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	40½	19	129½	.....	.....
Autocrat, Sibley..... 74 a	10	39	.....	.....	4	9	4	16	.....	.....	21	76½	.....	.....	37	173	64	318	.....	.....

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COMPARATIVE TABLE.—CONTINUED.

Name and Number of Variety. (Concluded from last page.)	Sept. 14.		Sept. 15.		Sept. 18.		Sept. 19.		Sept. 20.		Average weight of plants, oz.	Average number of fruits to a plant.	Average weight of fruits on a plant, oz.	Average weight of a fruit in oz.	Ratio of weight of fruit to weight of plant.	Number of days in germinating.	Per cent.
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.							
Victor, Neuman.....No. 33 a	----	------	------	------	314	526	------	------	------	------	88 1-3	111 2-3	287 11-12	2.578	3.455	13	68
Ex. Selected Trophy, Henderson. 35	----	------	------	------	------	------	379	906	------	------	118 2-5	99 1-5	300 1-5	3.026	2.535	8	70
Trophy, Dickson..... 37	----	------	------	------	------	------	353	1,174	------	------	127	84 1-3	311 1-3	3.691	2.451	8	64
" Neuman 38	----	------	------	------	------	------	350	1,024	------	------	100	81 1-3	332 2-3	4.092	3.326	8	38
" " ..... 38 a	----	------	------	------	------	------	941	1,984	------	------	180 1-3	217 1-6	524 1-3	2.414	4.023	10	30
Read's Island Beauty, Thorburn. 40 a	----	------	------	------	------	------	815	624	------	------	162 1-3	187 5-6	151 5-6	.808	.935	8	44
Bronze Foliage Trophy, " 41	----	------	------	------	------	------	240	732	------	------	217 1-2	68 1-2	207 3-4	3 271	.955	9	34
Queen, Nellis 42	----	------	------	------	------	------	578	980	------	------	145	144 1-2	345 1-2	2.391	2.382	10	42
" " ..... 42 a	----	------	------	------	------	------	622	1,618½	------	------	198 1-3	139 5-6	464 11-12	3.324	2.333	9	32
Cardinal, Henderson..... 44	----	------	------	------	------	------	824	1,457	------	------	179 2-3	166	355 3-4	2.143	1.98	9	44
" " ..... 44 a	----	------	------	------	------	------	923	1,608	------	------	279 1-3	190 5-6	411 1-6	2.154	1.471	10	46
" Thorburn..... 46	----	------	------	------	------	------	157	361½	------	------	100	92 1-2	250 1-4	2.705	2.502	8	8
" Neuman..... 47	----	------	------	------	------	------	722	1,801	------	------		144 1-3	373 1-6	2.585		8	80
" Dickson..... 48 a	----	------	------	------	------	------	1,245	2,494	------	------	208 1-3	184 7-8	406	2.196	1.994	10	18
" Root..... 49	----	------	------	------	------	------	1,034	2,352	------	------	150	119 2-5	318 7-20	2.666	2.122	10	66
" " ..... 49 a	----	------	------	------	300	312	------	------	------	------	160	267	407 1-2	1.526	2.547	11	4
Prize Belle, Buist..... 50 a	----	------	------	------	541	1,096	------	------	------	------	155 2-3	125 1-6	383 5-12	3.063	2.462	11	28
Red Valencia Cluster, Thorburn 51	----	------	------	------	415	930	------	------	------	------	161 1-5	112 3-5	314 3-10	2.791	1.949	8	34
" " 51 a	----	------	------	------	395	905	------	------	------	------	108 2-3	89 2-3	213	2.71	2.236	10	80
Livingston's Favorite, Sibley.... 52 a	----	------	------	------	540	1,026½	------	------	------	------	216	146 2-5	379 1-5	2.59	1.840	10	46
" " Hend..... 53	----	------	------	------	------	------	600	1,157½	------	------	189 2-3	134 1-2	346	2.572	1.824	8	32
" " Dickson.. 54	----	------	------	------	------	------	737	1,682	------	------	161	140	367 5-7	2.627	2.283	8	84
Market Champion, Ford..... 55 a	----	------	------	------	------	------	1,329	1,718	------	------	183 2-3	264 2-3	429 11-12	1.625	2.34	9	62
Champion, Neuman..... 56 a	----	------	------	------	------	------	946	3,336	------	------	163 9-11	111 8-11	423 1-2	3.79	2.753	10	54
Hathaway's Excelsior, Hend.... 58	----	------	------	------	------	------	------	------	1,398	1,888	133 1-3	144 5-6	252 3-4	1.745	1.895	9	59
" " " ... 58 a	----	------	------	------	------	------	668	708	------	------	84 2-3	151 5-6	258 1-2	1.702	3.053	10	72
" " Root.... 59 a	----	------	------	------	------	------	767	908	------	------	149 1-3	196 1-6	352 1-3	1.796	2.359	10	51
" " Dickson. 60 a	----	------	------	------	------	------	647	905½	------	------	180 4-5	171 3-5	327 9-10	1.91	1.813	12	12
" " Vilmorin 61	----	------	------	------	------	------	602	920	------	------	181 1-3	122 1-2	239 1-12	1.951	1.318	10	84
New Red Apple, Gregory..... 63	----	------	------	------	------	------	586	1,196	------	------	166 2-3	118 1-2	295 1-3	2.492	1.772	8	59
" " " ..... 63 a	----	------	------	------	------	------	------	------	619	810	281 1-3	141 1-3	325 7-12	2.3	1.157	10	52
Advance, Ford..... 66	----	------	------	------	------	------	------	------	630	812	97 1-3	201 5-6	384 5-6	1.906	3.953	8	36
" " ..... 66 a	----	------	174	519	------	------	------	------	1,806	1,954	173 1-3	352 5-6	497 2-3	1.325	2.698	9	64
Extra Early Advance, Burpee... 67	----	------	67	184	------	------	------	------	1,871	2,294	101 1-3	252 1-3	363 7-18	1.44	3.586	10	54
" " " ... 67 a	----	------	140	351	------	------	------	------	835	830	105 3-5	253 4-5	377 3-10	1.486	3.572	17	23
Perfection, Henderson..... 68	----	------	90	318	------	------	559	683⅓	------	------	149 1-3	127 2-3	224 1-3	1.757	1.502	7	64
Paragon, Henderson..... 71	80	247	------	------	------	------	719	944	------	------	156	180 1-3	344 5-12	1.909	2.207	10	30
" Neuman..... 72	52	416	------	------	------	------	463	1,316	------	------	134 2-3	90 2-3	323 3-4	3.57	2.404	8	72
" " ..... 72 a	93	552	------	------	------	------	712	1,730	------	------	146 2-3	141 1-2	406 5-6	2.875	2.773	11	27
Emery, Rawson..... 73 a	47	398	------	------	------	------	------	------	615	1,528	165 1-3	115 1-2	351 2-3	3.044	2.127	10	48
Autocrat, Sibley..... 74 a	----	------	80	373	------	------	------	------	666	1,200	120	147 2-3	367 5-12	2.488	3.061	11	22

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COMPARATIVE TABLE.—CONTINUED.

Name and Number of Variety. (Concluded on next page.)	Aug. 17.		Aug. 20.		Aug. 23.		Aug. 25.		Aug. 27.		Aug. 31.		Sept. 4.		Sept. 5.		Sept. 8.		Sept. 14.	
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.
Mayflower, Henderson.....No. 75 a	12	38	----	----	3	7	7	18	------	------	19	72½	27	131	----	------	29	118	------	------
" Root..... 76 a	9	34	4	16	5	10	4	4½	------	------	45	108½	48	90	----	------	73	230	------	------
" Neuman..... 77 a	9	12	1	4	2	4	3	23½	------	------	38	93½	63	173	----	------	182	508	------	------
Scovill's Hybrid, Perry '86..... 78	----	----	----	----	----	----	1	6½	------	------	4	20½	5	39	----	------	30	214	------	------
" " " '87..... 79	5	18	1	3	----	----	3	10	11	62	32	132	28	141	----	------	27	138	------	------
" " " ..... 79 a	9	37	1	2	4	13	6	23	10	39	25	99	40	172	----	------	45	206	------	------
Rouge grosse, Vilmorin..... 80	3	16	3	9	2	7	3	18	------	------	17	79	28	81	----	------	73	232	147	490
Rouge grosse hative, Vilmorin.. 81	15	31	2	4	3	7	3	7	------	------	58	127	77	160	----	------	99	282	93	204
" " " " .. 82 a	----	----	----	----	----	----	----	----	------	------	3	25	10	69	----	------	38	286	44	302
Rouge naine hative " .. 83	3	6	4	7	3	7	11	40	------	------	37	121½	98	370	----	------	124	465	182	671
" " " " .. 83 a	13	34	3	8	5	7	5	9	------	------	63	131	------	------	68	131	107	226	244	516
Frühe rothe zwerg, Neuman.... 84 a	16	36	----	----	----	----	8	25	------	------	14	32½	------	------	53	172	62	226	204	508
Cedar Hill, " 86	----	----	3	6	3	7	7	28	------	------	58	210½	------	------	91	383	101	408	------	------
" " " ..... 86 a	4	(11)	1	1	1	2	----	----	------	------	21	58	------	------	74	231	112	404	------	------
Gestreifte, " 87	----	----	----	----	1	2	1	3	------	------	4	11½	------	------	19	49	23	93	------	------
Santa Catharina, " ..... 88 a	----	----	----	----	2	8	4	23	------	------	11	52½	------	------	39	153	30	94	------	------
Franz grosse rothe, " 89	1	3	----	----	----	----	9	26	------	------	21	68	------	------	57	204	78	214	120	311
" " " " ..... 89 a	27	71	13	31	9	31	----	----	------	------	38	114	------	------	115	344	133	422	201	628
Glatte Amerikan, " ..... 90 a	21	78	1	2½	11	27	7	20	------	------	26	108	------	------	48	169	50	250	41	194
Mills' Belle, F. B. Mills..... 91	----	----	----	----	----	----	----	----	------	------	2	11	------	------	12	60	13	78	------	------
Extra Early or Cluster, Landreth. 92	----	----	4	9	----	----	12	40	------	------	76	274½	------	------	117	431	65	234	------	------
" " " 92 a	7	39	3	19	4	9	1	2	------	------	11	47	------	------	37	199	66	326	------	------
Peach, Landreth..... 93	----	----	11	14	----	----	4	6	------	------	----	----	------	------	5	6	39	79	------	------
Stamfordian, Dickson ..... 94 a	10	16	1	5	----	----	4	13	------	------	58	169½	------	------	104	311	100	214	------	------
Hackwood Park Prolific, Dickson 95	----	----	5	6	4	18	1	4	------	------	14	78¾	------	------	27	163	30	202	------	------
Jackson's Favorite " 96	1	2½	----	----	----	----	----	----	------	------	15	69¾	------	------	14	87	38	158	------	------
Feejee, Neuman..... 99 a	----	----	----	----	----	----	----	----	------	------	----	----	------	------	1	4	3	13	------	------
Rochester Favorite, Gregory.... 100 a	14	29	5	11	1	2	5	12	------	------	----	----	------	------	49	144	80	290	------	------
" Sibley..... 101	----	----	----	----	----	----	----	----	------	------	4	17½	------	------	25	105	6	54½	------	------
" " 101 a	----	----	----	----	----	----	----	----	------	------	18	50	------	------	8	57	7	43	------	------
Livingston's Acme, Gregory..... 103	15	34	4	7	12	33	12	40	------	------	24	101½	------	------	68	231	47	178	------	------
Acme, Dickson..... 104	7	35	----	----	9	31	1	4	------	------	34	123	------	------	54	255	35	166	------	------
" " ..... 104 a	----	----	----	----	2	5	----	----	------	------	15	58½	------	------	17	75	24	146	------	------
" Vilmorin..... 105	----	----	----	----	----	----	2	4	------	------	----	----	------	------	30	143	35	198	------	------
" " " ..... 105 a	1	2	----	----	2	3	4	7	------	------	9	23	------	------	26	127	23	86	------	------
" Neuman 106	4	14	----	----	3	13	1	4	------	------	7	28	------	------	28	151	39	184	------	------
" " ..... 106 a	1	5	3	8	----	----	----	----	------	------	27	63½	------	------	47	123	55	158	------	------
Livingston's Beauty, Rawson ... 107 a	----	----	----	----	2	8	1	3	------	------	3	13½	------	------	8	35	14	72	------	------
" Livingston. 108	----	----	----	----	----	----	----	----	------	------	----	----	------	------	18	115	36	228	------	------
" " " 108 a	3	9	2	3	----	----	----	----	------	------	2	4¾	------	------	18	111	----	----	------	------
Climax, Rawson..... 109 a	27	65	8	17	2	5	11	34	------	------	60	146	------	------	101	299	78	222	------	------
Hovey, Thorburn..... 110 a	1	2	1	2	------	------	3	7	------	------	20	65½	------	------	37	151	19	74	------	------

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COMPARATIVE TABLE.—CONTINUED.

Name and Number of Variety. (Concluded from last page.)	Sept. 15.		Sept. 19.		Sept. 20.		Sept. 21.		Average weight of plants, oz.	Average number of fruits to plant.	Average weight of fruits on a plant, oz.	Average weight of a fruit in oz.	Ratio of weight of fruit to weight of plant.	Number of days in germinating.	Per cent.
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.							
Mayflower, Henderson.....No. 75 a	167	427	.....	.....	556	910	.....	.....	157 1-3	136 2-3	286 11-12	2.099	1.823	10	28
" Root..... 76 a	180	616	.....	.....	1,000	1,654	.....	.....	117	228	460 1-2	2.02	3.935	9	54
" Neuman ..... 77 a	484	1,323	.....	.....	2,074	2,69 ⅓	.....	.....	80	317 8-9	537 1-2	1.69	6.718	10	76
Scovill's Hybrid, Perry 86..... 78	26	100	.....	.....	621	1,727	.....	.....	119 1-3	114 1-2	351 1-6	3.066	2.944	7	30
" " " 87..... 79	25	120	.....	.....	480	864	.....	.....	128	102	248	2.431	1.937	8	48
" " " ..... 79 a	31	135	.....	.....	348	553⅓	.....	.....	118 2-3	86 1-2	213 1-4	2.465	1.797	10	28
Rouge grosse, Vilmorin 80	.....	.....	.....	.....	396	737	.....	.....	81 1-3	102	293 1-6	2.874	3.604	8	56
Rouge grosse hative, Vilmorin.. 81	.....	.....	.....	.....	666	732	.....	.....	64	207 1-5	298 4-5	1.442	4.668	10	62
" " " " .. 82 a	.....	.....	.....	.....	239	561⅓	.....	.....	66	55 2-3	207 1-4	3.723	3.14	10	24
Rouge naine hative, " .. 83	.....	.....	.....	.....	597	990	.....	.....	109 1-3	176 1-2	446 1-4	2.528	4.081	7	46
" " " " .. 83 a	.....	.....	.....	.....	753	799	.....	.....	82 2-3	210 1-6	309 1-3	1.471	3.742	10	34
Frühe rothe zwerg, Neuman..... 84 a	.....	.....	.....	.....	924	1,614	.....	.....	150 2-3	213 1-2	435 7-12	2.04	2.891	9	44
Cedar Hill, Neuman 86	135	558	.....	.....	557	1,230	.....	.....	106 2-3	159 1-6	468 5-12	2.942	4.391	9	86
" " " ..... 86 a	157	580	.....	.....	870	1,690⅓	.....	.....	144	206 2-3	496 1-4	2.4	3.445	9	82
Gestreifte, " 87	108	303	.....	.....	204	564	.....	.....	80	119 1-3	321 5-6	2.696	4.022	10	88
Santa Catharina, Neuman..... 88 a	57	236	206	252	.....	.....	.....	.....	322 2-3	116 1-3	272 5-6	2.345	.845	11	10
Franz grosse rothe, " 89	.....	.....	530	814	.....	.....	.....	.....	86	136	273 1-3	2.009	3.178	10	86
" " " " ..... 89 a	.....	.....	555	844	.....	.....	.....	.....	93 1-3	181 5-6	414 1-6	2.277	4.437	10	38
Glatte Amerikan, " ..... 90 a	.....	.....	.....	.....	605	1,151	.....	.....	141 1-3	125	333 1-4	2.488	2.357	10	38
Mills' Belle, F. B. Mills..... 91	43	271	.....	.....	585	1,304	.....	.....	156 4-5	130 4-5	344 4-5	2.636	2.197	10	82
Extra Early or Cluster, Landreth 92	60	256	.....	.....	.....	.....	296	492	73 3-5	126	347 3-10	2.756	4.718	9	100
" " " " 92 a	144	687	.....	.....	.....	.....	285	934	85 1-3	98	377	4.053	4.418	10	48
Peach, Landreth 93	96	197	.....	.....	.....	.....	2,325	1,672	264	413 1-3	329	.795	1.246	8	90
Stamfordian, Dickson ..... 94 a	159	497	.....	.....	.....	.....	906	1,630	88	223 2-3	475 11-12	2.127	5.408	9	58
Hackwood Park Prolific, Dickson 95	66	415	.....	.....	.....	.....	407	1,258	147 1-5	110 4-5	427 9-10	3.881	2.906	8	60
Jackson's Favorite, " 96	75	262	.....	.....	.....	.....	411	750	86 2-5	110 4-5	255 4-5	2.308	2.960	8	66
Feejee, Neuman..... 99 a	.....	.....	.....	.....	158	348	.....	.....	120	81	182 1-2	2.253	1.520	10	20
Rochester Favorite, Gregory..... 100 a	.....	.....	.....	.....	559	873	.....	.....	112	118 5-6	226 5-6	1.9	2.025	9	66
" Sibley..... 101	62	416	.....	.....	280	1,013	.....	.....	143 1-3	62 5-6	282 2-3	4.5	1.972	8	80
" " ..... 101 a	107	341	.....	.....	166	601½	.....	.....	124	76 1-2	273 1-8	3.57	2.202	9	32
Livingston's Acme, Gregory..... 103	127	69	.....	.....	887	1,526	.....	.....	109 5-7	170 6-7	317 1-14	1.854	2.89	8	66
Acme, Dickson..... 104	179	924	.....	.....	.....	.....	550	1,042	117 1-3	144 5-6	430	2.988	3.664	8	64
" " ..... 104 a	.....	.....	.....	.....	.....	.....	712	1,441	165 1-3	130	287 7-12	2.212	1.789	9	62
" Vilmorin 105	165	687	.....	.....	.....	.....	518	1,182	136	125	369	2.952	2.713	10	40
" " ..... 105 a	.....	.....	.....	.....	.....	.....	958	1,536	129 1-7	147 4-7	254 5-7	1.726	1.979	9	76
" Neuman 106	135	482	.....	.....	.....	.....	912	1,928⅓	184	188 1-6	467 5-12	2.484	2.54	10	44
" " ..... 106 a	143	364	.....	.....	799	1,123	.....	.....	41 3-5	215	368 9-10	1.715	8.867	9	36
Livingston's Beauty, Rawson..... 107 a	.....	.....	.....	.....	880	816	.....	.....	121 3-5	81 2-5	189 1-2	2.328	1.558	10	66
" " Livingston. 108	74	495	.....	.....	402	991	.....	.....	124 4-5	106	365 4-5	3.45	2.931	9	62
" " " 108 a	.....	.....	.....	.....	.....	.....	484	940	141 1-3	84 5-6	177 11-12	2.097	1.258	10	36
Climax, Rawson..... 109 a	156	448	.....	.....	.....	.....	779	947⅓	252 4-5	214 2-5	436 7-10	1.786	1.727	9	31
Hovey, Thorburn..... 110 a	78	328	.....	.....	.....	.....	676	1,140	82 2-3	139 1-6	294 11-12	2.1	3.567	9	64

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COMPARATIVE TABLE.—CONTINUED.

Name and Number of Variety. (Concluded on next page.)		Aug. 17.		Aug. 20.		Aug. 22.		Aug. 25.		Aug. 31.		Sept. 1.		Sept. 5.		Sept. 8.	
		No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.
Optimus, Ferry	No. 114	4	12	.....	.....	.....	.....	.....	.....	14	66	.....	.....	32	123	25	110
" "	114 a	.....	.....	2	2	.....	.....	.....	.....	.....	.....	8	35	24	98	25	94
Cincinnati Purple, Ferry	115 a	10	23	3	4	.....	.....	6	12	.....	.....	21	37	86	231	39	238
Vick's Criterion, Henderson	117 a	.....	.....	10	20	1	3	.....	.....	.....	.....	10	20	25	54	17	38
" " Dickson	118 a	.....	.....	10	17	4	8	10	22	12	32½	.....	.....	21	47	24	58
King Humbert, Rawson	119	5	10	1	3	5	12	1	2½	4	5½	.....	.....	21	41	46	78
" " Dickson	120 a	.....	.....	2	2	.....	.....	1	2½	7	13½	.....	.....	17	29	12	26½
" " Vilmorin	121 a	4	5	22	21	6	7½	2	1½	95	85½	.....	.....	253	262	301	322
" " Neuman	122 a	.....	.....	.....	.....	.....	.....	.....	.....	2	2	.....	.....	30	39	55	78
Golden Queen, Rawson	124	2	5	1	2	.....	.....	.....	.....	21	37	.....	.....	44	126	42	122
" "	124 a	1	2	.....	.....	.....	.....	.....	.....	10	36	.....	.....	14	55	30	125
Golden Trophy "	125	1	2	.....	.....	3	7	26	13	.....	.....	53	80	19	98	23	146
Yellow Victor, Gregory	126 a	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	98	133	44	151	43	144
Yellow Jefferson, Leonard	127	.....	.....	.....	.....	.....	.....	3	12	.....	.....	5	24	23	121	29	242
Jaune Grosse Lisse, Neuman	128	14	24	.....	.....	.....	.....	2	9	.....	.....	15	50	22	89	16	37
New White Apple, Thorburn	131	15	14	3	3	4	4½	.....	.....	.....	.....	22	27	40	53	108	142
" " "	131 a	.....	.....	.....	.....	.....	.....	4	6	.....	.....	24	27½	34	43	68	86
Snowball, Nellis	132 a	.....	.....	3	3	.....	.....	.....	.....	.....	.....	15	17	28	35	70	90
Apfel Weisser, Neuman	133 a	.....	.....	2	3	.....	.....	.....	.....	.....	.....	5	5½	10	15	55	74
Green Gage, Henderson	134	13	8	10	6½	8	6	6	3	.....	.....	83	59	284	163	425	280
" " "	134 a	13	6	15	12	.....	.....	5	3	.....	.....	72	57	332	255	278	192
" " Neuman	135 a	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	6	54	97½	33	75
" " Dickson	135½ a	1	1	.....	.....	.....	.....	2	3	.....	.....	26	41	24	42½	60	92
Large Yellow, Sibley	136	2	2	.....	.....	.....	.....	2	3	.....	.....	9	20	18	54	32	68
Little Gem, Gregory	137	.....	.....	.....	.....	4	7	10	19	.....	.....	16	27	17	26	142	285
" " Neuman	138 a	.....	.....	6	2	7	9	23	28	.....	.....	83	105	38	38½	183	240
Red Cherry, Henderson	139	.....	.....	.....	.....	8	1½	7	4	.....	.....	90	22	85	7	62	18½
" "	139 a	43	7	.....	.....	16	3	18	2½	.....	.....	108	22	91	17	100	20
Kirsch rothe, Neuman	140 a	65	16	4	1	18	5	16	4	.....	.....	105	28	55	14	60	20
Yellow Cherry, Thorburn	141	.....	.....	9	1½	14	1½	17	2	.....	.....	94	12½	77	9	170	19
Gelbe Kirsch, Neuman	142	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13	6	20	13	45	38
" " "	142 a	.....	.....	.....	.....	3	3	.....	.....	.....	.....	15	5	16	10	65	38
Cerise, Vilmorin	143	.....	.....	.....	.....	.....	.....	4	1½	.....	.....	32	16	38	18	255	72½
Pear shaped, Henderson	146	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	7	15	10	98	72
Poire, Vilmorin	148	56	8	7	1½	.....	.....	104	15½	.....	.....	11	2	36	13	182	68
" "	148 a	5	2	.....	.....	.....	.....	3	1	.....	.....	12	4	26	10	232	85
Wonder of Italy, Burpee	149	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16	11	26	18½	247	200
" " "	149 a	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	12	32	34	17	15

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COMPARATIVE TABLE.—CONTINUED.

Name and Number of Variety. (Concluded from last page.)	Sept. 15.		Sept. 21.		Sept. 22.		Average weight of plants, ozs.	Average number of fruits to a plant.	Average weight of fruits on a plant, ozs.	Average weight of a fruit in ozs.	Ratio of weight of fruit to weight of plant.	Number of days in germinating.	Per cent.
	No. ripe.	Weight, ozs.	No. ripe.	Weight, ozs.	No. ripe.	Weight, ozs.							
Optimus, Ferry..... No. 114	47	257	448	261	.....	.....	136	95	138 1-6	1.454	1.015	8	44
" " ..... 114 a	83	287	800	1,240½	.....	.....	148	157	292 3-4	1.864	1.977	9	18
Cincinnati Purple, Ferry..... 115 a	156	439	647	1,052	.....	.....	160	193 3-5	407 1-6	2.103	2.544	10	42
Vick's Criterion, Henderson..... 117 a	73	237	1,305	2,040	.....	.....	198⅝	240 1-6	400 1-3	1.666	2.015	10	32
" " Dickson..... 118 a	86	220	928	1,398	.....	.....	130⅝	182 1-2	300 5-12	1.646	2.299	10	54
King Humbert, Rawson..... 119	289	399	1,431	1,165	.....	.....	93½	297 1-6	286	.962	3.064	7	56
" " Dickson..... 120 a	62	104	618	604	.....	.....	124	362 1-2	390 3-4	1.077	3.151	12	28
" " Vilmorin..... 121 a	587	537	5,925	2,370	.....	.....	161	719 1-2	361 3-20	.501	2.245	10	76
" " Neuman..... 122 a	118	140	2,376	1,730	.....	.....	137½	490 1-6	331 1-2	.77	2.413	9	50
Golden Queen, Rawson..... 124	74	249	660	1,012	.....	.....	109½	140 2-3	258 5-6	1.84	2.367	10	74
" " " ..... 124 a	72	286	645	1,171	.....	.....	124	128 2-3	279 1-6	2.169	2.251	11	26
Golden Trophy. " 125	80	159	427	872½	.....	.....	154⅝	96 5-6	229 7-12	2.37	1.484	7	34
Yellow Victor, Gregory..... 126 a	71	245	235	572	.....	.....	90⅝	163 2-3	415	2.535	4.577	10	48
Yellow Jefferson, Leonard..... 127	52	307	.....	.....	501	1,133½	168⅝	102	306 7-12	3.005	1.817	8	62
Jaune Grosse Lisse, Neuman..... 128	49	248	.....	.....	523	1,358.	166	160 1-4	453 3-4	2.831	2.733	7	60
New White Apple, Thorburn..... 131	172	178	.....	.....	180	121	176	544	537 1-2	.988	3.054	8	72
" " " " ..... 131 a	171	178	.....	.....	1,151	748	183½	242	181 5-12	.749	.989	11	70
Snowball, Nellis..... 132 a	145	188	.....	.....	1,508	1,092	173½	294 5-6	237 1-2	.805	1.37	11	38
Apfel Weisser, Neuman..... 133 a	137	184	.....	.....	1,755	1,340	240	327 1-3	270 1-4	.825	1.126	10	26
Green Gage, Hende son..... 134	643	444	.....	.....	635	206	113	2,056	1,175 1-2	.571	10.495	8	64
" " " ..... 134 a	558	300	.....	.....	524	164	96	1,796	999	.556	10.405	11	20
" " Neuman..... 135 a	142	169	.....	.....	1,150	1,043	224	236 2-3	231 3-4	.981	1.034	10	63
" " Dickson..... 135½ a	118	141	.....	.....	1,320	1,028½	242	258 1-2	224 5-6	.87	.929	11	87
Large Yellow, Sibley..... 136	96	368	.....	.....	498	524	382	164 1-4	269 3-4	1.581	.68	9	60
Little Gem, Gregory..... 137	145	245	.....	.....	280	204	208	614	793		1.291	3.812	9	42
" " Neuman..... 138 a	146	160	.....	.....	141	79	176	627	661 1-2		1.055	3.758	9	56
Red Cherry, Henderson..... 139	363	48	.....	.....	186	112	240	751	208		.277	.866	10	72
" " " ..... 139 a	.....	.....	.....	.....	776	66	124	1,146	137 1-2		.12	1.108	10	80
Kirsch rothe, Neuman..... 140 a	320	68	.....	.....	581	79	192	1,224	235		.192	1.192	9	70
Yellow Cherry, Thorburn..... 141	.....	.....	.....	.....	1,050	73	140	1,431	118 1-2		.082	.846	10	48
Gelbe Kirsch, Neuman..... 142	.....	.....	.....	.....	500	179	200	578	236		.408	1.18	10	52
" " " ..... 142 a	.....	.....	.....	.....	424	152	152	528	208		.398	1.368	9	62
Cerise, Vilmorin..... 143	.....	.....	.....	.....	655	151	120	984	259		.263	2.158	10	82
Pear shaped, Henderson..... 146	38	20	.....	.....	347	112	160	510	221		.433	1.381	9	54
Poire, Vilmorin..... 148	100	29	.....	.....	754	114	168	1,250	251		.2	1.494	9	68
" " ..... 148 a	64	17	.....	.....	482	77	152	824	196		.237	1.29	11	50
Wonder of Italy, Burpee..... 149	73	47	.....	.....	318	100	154	680	376 1-2		.553	2.444	10	30
" " " ..... 149 a	62	63	.....	.....	264	130	152	337	254		.656	1.671	10	80

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COMPARATIVE TABLE.—CONTINUED.

Name and Number of Variety. (Concluded on next page.)		Aug. 17.		Aug. 18.		Aug. 20.		Aug. 22.		Aug. 25.		Sept. 1.		Sept. 6.		Sept. 8.	
		No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.
Queen of Tomatoes, Dickson	No. 150 a	8	2	.....	.....	.....	.....	.....	.....	3	1	4	1	34	12⅛	59	21
Nisbits Victoria, Nellis	151	.....	.....	.....	.....	.....	.....	7	3¼	.....	.....	7	2	31	11⅛	61	25
" " "	151 a	12	6	.....	.....	.....	.....	.....	.....	.....	.....	20	9	40	18	25	12¼
" " Dickson	152 a	11	4	.....	.....	.....	.....	.....	.....	2	1	10	4	22	11⅛	18	10
Yellow Plum, Henderson	153	8	4	.....	.....	2	1	6	2	.....	.....	14	5	39	16	24	14
" " "	153 a	.....	.....	13	7	3	2	4	2	4	2	24	12	36	20	28	15
Eiformige Dauer, Small, Neuman	154	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	6½	14	15	17	18⅜
" " (Ignotum) Large, Neuman	154	1	2	.....	.....	1	3	4	11⅛	3	16	23	115	43	196	9	40
Mikado, Henderson	155	11	42	.....	.....	6	18	.....	.....	.....	.....	23	145	85	510	17	150
Potato Leaf, Livingston	161	13	28	.....	.....	.....	.....	11	42	.....	.....	40	173	85	356	28	62
New French Upright, Thorburn	162	.....	.....	.....	.....	.....	.....	.....	.....	7	22	3	19	1	4½	.....	.....
Rouge à tige raide de Laye, Vilmorin	163	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	25	21	70
Grenier mit aufrechten stamme, Neuman	164	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	3	4	15⅛	1	4
Station Tomato, Ripe, N. Y. Ex. Station	165	1	1	.....	.....	.....	.....	.....	.....	.....	.....	4	7	3	8	1	4
" " " Green, " " "	165	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14	50	5	9
New Currant, Thorburn	166	9	1	.....	.....	.....	.....	.....	.....	8	1	261	18	232	11	56	3
" " "	166 a	33	3	.....	.....	18	1¼	.....	.....	34	2	715	34⅛	511	21	107	4⅛
Rothe Johannes beerfruchten, Neuman	167 a	.....	.....	25	1⅛	23	2	33	1½	42	2	392	19	282	12⅛	207	9
Sunset, Tillinghast	168	.....	.....	6	16	.....	.....	.....	.....	.....	.....	.....	.....	18	75⅛	11	52
" "	168 a	.....	.....	.....	.....	3	10	.....	.....	3	7	18	46	36	187⅛	24	96
Puritan, Rawson	170	.....	.....	.....	.....	.....	.....	1	2½	.....	.....	4	19	20	123	13	84
Americus Hybrid, Faust	171	.....	.....	10	35	.....	.....	.....	.....	3	10	14	64	29	192	17	133
Dwarf Champion, Henderson	172	.....	.....	2	11	.....	.....	.....	.....	.....	.....	9	32	20	89⅛	18	81⅛
Glen Cove, Burpee	173	.....	.....	2	8	.....	.....	.....	.....	1	2	1	7	6	29	.....	.....
New Bay State, Bragg	174	.....	.....	1	6	.....	.....	.....	.....	.....	.....	1	4⅛	24	50	3	18
Volunteer, Hallock	175	.....	.....	.....	.....	.....	.....	.....	.....	1	4	.....	.....	16	91⅛	14	74
King of the Earlies, Ely	176	.....	.....	2	8	2	2	.....	.....	4	17	61	196	134	396⅛	58	188
Potato Leaf, Mills	177	.....	.....	5	14	.....	.....	1	1½	.....	.....	25	57	54	236	14	75⅛

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COMPARATIVE TABLE.—CONTINUED.

Name and Number of Variety. (Concluded from last page.)	Sept. 10. No. ripe.	Sept. 10. Weight, oz.	Sept. 15. No. ripe.	Sept. 15. Weight, oz.	Sept. 22. No. ripe.	Sept. 22. Weight, oz.	Average weight of plants, oz.	Average number of fruits to a plant.	Average weight of fruits on a plant, oz.	Average weight of a fruit in oz.	Ratio of weight of fruit to weight of plant.	No. of days in germinating.	Per cent.
Queen of Tomatoes, Dickson.....No. 150 a	.....	.....	133	43	891	176	112	1,132	256 1-2	.226	2.29	10	75
Nisbit's Victoria, Nellis..... 151	.....	.....	115	32	529	133	144	750	207	.276	1.437	9	78
" " " ..... 151 a	.....	.....	119	35	653	164	124	869	244 1-2	.281	1.971	10	63
" " Dickson..... 152 a	.....	.....	82	43	1,261	317	188	1,406	390 1-2	.277	2.077	9	92
Yellow Plum, Henderson..... 153	.....	.....	75	25	498	91¼	112	666	158 1-2	.238	1.415	7	86
" " " ..... 153 a	.....	.....	65	29	656	171	144	833	260	.312	1.805	10	56
Eiformige Dauer, Small, Neuman..... 154	.....	.....	33	34	2,304	1,566	250¾	410 2-3	273 1-3	.665	1.09	7	86
" " (Ignotum) Large, Neuman..... 154	.....	.....	57	280	386	866	140	87 5-6	254 11-12	2.9	1.82	8	86
Mikado, Henderson..... 155	.....	.....	150	1,027	387	1,351	65¼	75 4-9	360 1-3	4.77	5.515	8	56
Potato Leaf, Livingston..... 161	.....	.....	155	580	680	1,595	56	125 7-8	354 1-2	2.816	6.329	10	80
New French Upright, Thorburn..... 162	4	26¾	3	11	25	64	41¼	14 1-3	49	3.418	1.185	10	12
Rouge à tige raide de Laye, Vilmorin..... 163	5	28½	17	88	41	114	35½	14 2-3	42 7-12	2.9	1.205	10	30
Grenier mit aufrechten stamme, Neuman..... 164	2	8	16	41	47	104	37¼	11 5-6	29 1-4	2.47	.783	12	30
Station Tomato, Ripe, N. Y. Ex. Station..... 165	8	25	5	11	52	35¾	26¾	24 2-3	80 1-2	1.236	1.144	12	10
" " Green, " " " " 165	.....	.....	8	22	79	100	17	13 1-4	22 5-8	1.707	1.33	12	26
New Currant, Thorburn..... 166	.....	.....	510	16	5,049	128	72	6,126	173	.028	2.402	8	92
" " " ..... 166 a	.....	.....	679	24	6,020	110	82	8,116	199 1-2	.024	6.234	9	46
Rothe Johannes beerfruchten, Neuman..... 167 a	.....		584	21	3,505	79	88	5,098	138 1-2	.027	3.644	9	84
Sunset, Tillinghast..... 168	.....	.....	59	272	778	1,572	256	145 1-3	331 1-4	2.279	1.236	9	44
" " " ..... 168 a	.....	.....	51	381	729	1,396	133½	144	345 7-12	2.4	2.591	9	52
Puritan, Rawson..... 170	.....	.....	51	335	533	1,267	149½	103 2-3	305 1-12	2.942	2.712	8	66
Americus Hybrid, Faust..... 171	.....	.....	67	424	572	1,363	136	118 2-3	370 1-6	3.119	2.721	11	22
Dwarf Champion, Henderson..... 172	.....	.....	36	151	415	784	54	83 1-3	191 1-2	2.298	3.548	11	50
Glen Cove, Burpee..... 173	.....	.....	32	205	427	998	133½	78 1-6	208 1-6	2.663	1.561	9	78
New Bay State, Bragg..... 174	.....	.....	60	381	700	1,648	197½	131 1-2	351 1-4	2.671	1.78	9	68
Volunteer, Hallock..... 175	.....	.....	68	312	571	1,476	224	134	391 1-2	2.921	1.747	10	46
King of the Earlies, Ely..... 176	.....	.....	184	612	669	1,693	88	185 1-6	517 3-4	2.796	5.883	10	84
Potato Leaf, Mills..... 177	.....	.....	47	224	1,036	1,883	226¾	197	415 1-6	2.107	1.831	10	56

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NO. 49.—DEPARTMENT OF CHEMISTRY.

CHEMICAL COMPOSITION OF—

1. CORNSTALKS AND ENSILAGE AT DIFFERENT PERIODS OF GROWTH.
2. MARSH HAY FROM PAW PAW.
3. WHEAT SCREENINGS FROM KALAMAZOO.

CORNSTALKS AND ENSILAGE.

The chemical composition of cornstalks at different periods of growth, and of the ensilage made from the same, has been a matter of inquiry by intelligent farmers and stockmen, in order to fix upon the time for cutting fodder corn to secure the best results. The following investigation has been made as a contribution to this subject, and, while the results are not as decisive as could be desired, it is hoped they will be of some value in settling this question.

Fodder plants at earlier periods of growth have greater food value, pound for pound of dry matter, than the same plants at complete maturity, because, in ripening, a part of the carbhydrates pass into indigestible condition as woody fibre. But the total food value produced on an acre greatly increases with advanced growth, from the rapid increase of digestible material along with this increase of woody fibre.

The acreage food value of a fodder crop will be at its maximum when there is the largest amount of digestible albuminoids and carbhydrates, and the least relative amount of indigestible fibre. The percentage chemical composition, therefore, will have to be interpreted with reference to this acreage increase of the crop.

The food value may be computed in three ways:

1. By chemical composition.
2. By digestion experiments.
3. By feeding stock.

The last method would seem to be the most natural and decisive. There are two objections to it. First, a number of animals must be fed in order to eliminate the personal differences in feeding quality in different animals. Second, animals require a change of food, and will not thrive if confined to one kind of food for some time.

A combination of chemical analysis and digestion experiments promises the best results. The work this year has been mainly devoted to the chemical analysis.

The plan adopted was to gather a specimen of corn as soon as it tasseled, make a chemical analysis of a part, and place the balance in a silo for future analysis, and repeat this process every week until the corn was fully ripe. In practice, however, the fresh stalks were examined for the amount of water

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and dry matter at each cutting, and a quantity of the cut stalks was rapidly dried and saved for subsequent analysis.

The field of corn assigned for this investigation was planted with Burrill & Whitman's ensilage dent corn; planted in drills 3 feet 9 inches apart and one stalk on the average to every 10 inches in the row. The corn was choked for want of air space, and in central parts of the field formed few ears, and those poorly developed. The first cutting was on the 25th of August, the stalks being left in small bundles to wilt till the 27th, when the stalks were cut by a Champion hand cutter into pieces three-quarters of an inch long. A quantity of fresh stalks was secured on the 27th and cut in the same way, the wilted stalks being entered on the table as No. 1 and the fresh stalks as No. 2.

The cut material was immediately placed in small silos, pressed down firmly, and finally compressed by a strong screw and securely fastened. The silos were strong oak casks, with sides nearly straight, and strongly bound with iron hoops. A tightly fitting head completed the silo. The head was forced down by a strong screw, an "apple heading press" being used for the purpose. At intervals of one or two weeks the heads were screwed down as far as possible, and then fastened by cleats nailed on the inside of the cask. These silos answered the purpose very satisfactorily; a little mildew and decomposition at the surface, but the interior in excellent condition when opened in January, the silage having a pleasant odor of acetic ether and an agreeable taste.

No. 3 was cut for wilting September 1 and No. 4 was cut September 3, and both placed in the silo September 3. Nos. 5 and 6 were treated in the same way, September 8 and 10. On September 13 there was such strong indications of frost that No. 7 was gathered and placed in the silo at once. A killing frost on the morning of September 14 put an end to this part of the experiment.

The following table exhibits the percentage of dry matter in the wilted stalks, fresh stalks, and the ensilage made from them:

Condition of Stalks at time of Ensiling.	Corn Stalks.	Ensilage.	Day of Cutting.
No. 1—Wilted in two days	22.00	19.00	Aug. 25
No. 2—Fresh Stalks	17.25	16.00	Aug. 27
No. 3—Wilted two days	27.60	22.30	Sept. 1
No. 4—Fresh Stalks	21.70	16.25	Sept. 3
No. 5—Wilted two days	27.00	21.32	Sept. 8
No. 6—Fresh Stalks	21.98	18.60	Sept. 10
No. 7—Fresh Stalks	21.96	19.72	Sept. 13

The loss of dry matter in the process of ensiling, an average of 16 per cent, will attract attention.

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Sept. 3rd to 5th, specimens of corn were obtained from the farm department much more mature than the preceding numbers, and they are placed in the following table:

Hathaway Dent, ears glazing, per cent dry matter	26.44	Breck's Boston Market fodder corn (ears), per cent dry matter	28.22
Parish White Dent fodder corn, " " "	24.46	White Dent fodder corn (ears), per cent dry matter	34.97
Leaming fodder corn, " " "	23.23		

The chemical composition of the various specimens of cornstalks and ensilage from the same, will be found in the following table, the composition being expressed in per cent of the dry matter. In the same table is given the composition of ensilage from the farm department, made from corn not fully in the ear; and also as a curiosity, ensilage from corn that had been thoroughly frostbitten on a neighboring farm:

COMPOSITION OF CORNSTALKS AND ENSILAGE—PER CENT OF DRY MATTER.

	No. 1. Wilted.		No. 2.		No. 3. Wilted.		No. 4.		No. 5. Wilted.		No. 6.		No. 7.		Hathaway Dent.	Laboratory Ensilage.	Farm Ensilage.	Parish White Dent.	Leaming Fodder.	Breck's Boston Market.	White Dent.	Ensilage from Farm.	Ensilage from Frosted Corn.
	Cornstalks.	Ensilage.	Cornstalks.	Ensilage.	Cornstalks.	Ensilage.	Cornstalks.	Ensilage.	Cornstalks.	Ensilage.	Cornstalks.	Ensilage.	Cornstalks.	Ensilage.									
Crude fiber	27.87	30.75	31.15	32.20	28.72	28.85	27.27	30.30	28.61	29.70	28.52	30.20	26.79	29.50	19.50	20.46	19.20	25.25	24.32	24.57	21.65	28.72	23.60
Crude protein	8.87	10.06	10.06	9.37	9.19	9.19	10.87	8.10	8.97	7.44	9.19	7.87	8.31	7.09	8.63	7.81	8.06	7.60	6.56	8.50	8.09	9.13	6.56
Ether extract—fat	2.50	4.75	2.30	4.50	2.30	4.45	2.52	4.00	2.25	3.85	2.15	3.75	2. 25	3.55	2.10	4.20	4.00	1.65	1.50	1.75	2.40	5.00	3.50
Nitrogen free extract	54.23	47.67	48.71	47.25	58.77	50.46	53.18	50.32	54.63	53.06	54.57	51.63	58 09	54.42	66.57	64.24	65.46	59.25	61.76	61.87	63.47	49.27	60.26
Acetic acid	.....	1.10	.....	1.02	.....	.95	.....	.92	.....	.87	.....	.80	.....	.82	.....	.98	.61	.....	.....	.....	.....	1.29	1.50
Pure ash	6.53	6.77	7.78	6.58	6.02	7.55	6.16	7.28	5.54	5.95	5.57	6.55	4.56	5.44	3.20	3.29	3.28	6.25	5.86	3.31	4.39	7.88	6.08
Organic Nitrogen—																							
Total nitrogen	1.42	1.61	1.64	1.50	1.46	1.47	1.75	1.30	1.44	1.19	1.47	1.26	1.33	1.13	1.38	1.25	1.29	1.23	1.05	1.34	1.29	1.46	1.05
Albuminoid	1.05	.98	1.25	1.06	1.08	.95	1.30	.89	1.19	.78	1.19	.74	1.16	.67	1.09	.68	.81	1.01	.58	1.05	1.12	.87	.70
Amide	.37	.63	.39	.44	.38	.52	.45	.48	.25	.41	.28	.53	.17	.46	.29	.57	.45	.22	.17	.29	.17	.59	.35

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REMARKS ON THE PRECEDING TABLE.

1. The amount of crude fibre (woody matter) relatively diminishes as the corn approaches maturity, because there is so large increase of nitrogen free extract (starch, sugar, gum, etc.) This is distinctly seen in the Hathaway Dent, Breck's Boston Market, and White Dent, the three kinds having corn well developed, the first named being nearest ripe.

In the silo the crude fibre appears to increase, because of a sensible loss of carbhydrates (nitrogen free extract) from fermentation.

2. Crude protein includes all the nitrogenous materials usually called albuminoids, and certain materials of less value as food, called amides.

A small loss of crude protein is common in the silo, but the change from albuminoid to amide condition of the nitrogen compounds is the most striking feature of ensiling. These two facts would point to a loss of value in ensilage as compared with fresh cornstalks, or even the dry material when it has been rapidly and perfectly cured.

3. Ether extract includes not only the fat, but the waxy material, much of the coloring matter, etc. The notable increase of the ether extract in the ensilage, as compared with the cornstalks before ensiling, will attract attention. It can hardly be supposed that carbhydrates are converted into fat in the silo.

4. The marked increase of nitrogen free extract (members of the starch family) as the corn matures, and the progressive decrease of acid in the ensilage, show how greatly the corn improves as it approaches ripening. The relatively large amount of water and crude fibre in the young plant justifies the epithets "slush," and "swill," as applied to the ensilage made from such material.

The progressive decrease of percentage of ash as the plant matures is worth notice. In the experimental cuttings, No. 1 to No. 7, this change is seen, also, the small amount of ash in the riper specimens: Hathaway Dent, Breck's Boston Market and White Dent, and the larger amount in Parish White Dent and Leaming Fodder. This decrease follows the usual law in plant growth.

MARSH HAY.

The wild grasses (sedges) that grow so abundantly in the marshes in many parts of Michigan are often mowed and cured for hay. The value of this marsh hay for fodder is a matter of uncertainty in public estimation, and the experiment station has been invited to investigate and report.

The value of this marsh hay will depend upon the kind of "grasses" used, and the period of cutting, and the manner of curing. The coarse sedges, covered with a sharp silicious crust when ripe, will make very inferior hay, but the fine sedges made into hay before hardening and ripening, will make a much better fodder.

A good specimen of such marsh hay was obtained from Hon. A. C. Glidden of Paw Paw, who spoke highly of its feeding quality. The analysis of this material is given below, and shows that it compares favorably with the average of timothy hay.

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COMPOSITION OF MARSH HAY.

Water, per cent	7.86
Ash. "	4.20
Crude fiber, per cent	27.55
Albuminoids	7 00
Ether extract—fat	3.60
Nitrogen free extract—carbhydrates	49.97
	100.00

This material contained no amides.

WHEAT SCREENINGS.

A gentleman in Kalamazoo sent to this station two packages of wheat screenings for analysis, to learn something of their value as food for stock.

The screenings consist of broken grain, shrunken wheat, chess, cockle, seeds of weeds (pea vine especially), and fragments of straw, chaff, etc.

The screenings were analyzed, and the results appear in the following table:

COMPOSITION OF WHEAT SCREENINGS.

	No. 1.	No. 2.
Water, per cent	7.80	8.40
Ash	3.80	3.76
Crude fiber	4.95	6.10
Crude protein	14.78	15.06
Ether extract—fat	2.65	3.03
Nitrogen free extract	66.02	63.65
	100.00	100.00
Nitrogen, total	2.36	2.41
Albuminoid nitrogen	2.00	2.14
Amide nitrogen	.36	.27

Shrunken and immature wheat has little value for making flour, and many persons suppose that its food value is of a low order. But young grains are richer in nitrogen compounds than the fully ripened and plump berry. The value of such grains for stock feeding is not to be measured by their flour producing quality. These wheat screenings are worth more for stock food than the same weight of plump wheat. The value of such materials when ground and fitted for mixing with coarse materials like straw, etc., is obvious to the intelligent stock feeder. The material should be ground to kill all seeds of weeds, as well as to secure complete digestion.

In presenting the material for this bulletin, I wish to acknowledge the valuable labors of G. L. Teller, my efficient assistant in the work of the experiment station.

R. C. KEDZIE,
Chemist, Experiment Station.

Agricultural College, May, 1889.

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NO. 50—ZOÖLOGICAL DEPARTMENT.

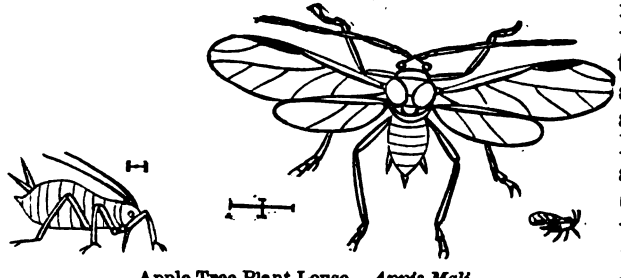
THE GRAIN PLANT LOUSE.

Aphis (Siphonophora) avenæ.

The present season is characterized by one of those wide-spread and very damaging insect invasions that is so discouraging to the farmer. I refer to the present onslaught on the wheat crop by the grain aphis or plant louse, *Aphis avenæ*. This louse attacks wheat, barley, oats and rye, and is to be found in small numbers on these grains every year. This year occurs one of those terrible attacks that seem to threaten very serious loss. This raid extends from Ohio west to Indiana and north to Grand Rapids, Michigan. Of this much I am certain. I do not know whether it reaches in such overwhelming numbers to other States or not. So abundant are these lice that they have attracted wide attention and awakened serious alarm. For the past two weeks I have received daily numerous specimens of these lice with the inquiry: What is to be the outcome of this attack? I have received as high as fifteen such communications in a single day.

WHAT IS IT?

This is a plant louse, or aphis, and is very similar to those that attack our house plants, cherry, plum and apple trees (see Fig.), cabbages and hops. Indeed, so numerous are the species of these lice that hardly one of our valued plants but has its plant-louse enemy. These plant-lice (see Fig.) have flask-shaped bodies, are usually green or black, though sometimes they are yellow or red, and are usually quite small. In looking at the grain aphis at this season (see Fig.) four forms will be seen: a small wingless louse, a large wingless form—the full grown apodous or wingless louse; the pupa of the winged louse, which has short wing pads; and the mature winged louse. We usually find these four forms at some season of the year in all plant lice colonies. Frequently, and this was true a few days ago of this grain aphis, we only find the wingless forms. Later the pupæ with wing-pads and the fully developed winged forms are seen. These winged lice are doubtless developed that the lice may spread before their food is wholly destroyed and they confronted by famine. The mature wingless louse of this grain aphis is about one-tenth of an inch long. The winged louse is nearly twice as long to the end of the wings. This louse is not quite as slim as is aphis mali (see Fig.). As will be observed by



Apple Tree Plant Louse.—*Appis Mali.*
Winged form natural size and much magnified. Wingless form much magnified. Short lines show natural size.

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examining the lice, or by studying the figure, these lice have long, seven-jointed antennæ—the horn-like organs appended to the head, and the winged lice have simple veined wings. The main vein of each wing is branched. There are four branches in the front or primary wings. The outer one is strongly curved and the next one branches twice. There are two simple branches on the posterior wing. This style of venation is characteristic of the genus aphis. We also note (see Fig.) that there are two short spine-like projections, black in the grain aphis, on the third part of the abdomen. These are the nectaries or honey tubes, so called because there frequently exudes from them a nectar which attracts ants and bees to these lice. Just now (June 26, 1889) a species of plant louse on our Norway spruces are secreting nectar so profusely that in the early morning it stands on the leaves in drops, so that it can be tasted. It seems very pleasant to the taste, and is giving the bees a fine harvest. This peculiar physiological characteristic serves the louse in this way: by attracting ants, wasps and bees, the birds and insect enemies of the lice are frightened away. I find that the oats and wheat are visited by ants that the nectar secreted by this grain aphis may be secured. The beak of this grain aphis is strong, dark in color, and about one-third the length of the body. With this the louse sucks the sap and devitalizes the plants. The feet and joints of the legs and also the antennæ are dark or dusky in color.

The color in these lice varies greatly. Early in the season while they are on the leaves or stalks they are green. This is the color now of all healthy lice on the oats. After they migrate to the heads they often turn yellowish green and even rust red, though I find that now the green color prevails even with the lice which are gathered thickly about the kernels. Some of the winged lice are very dark, almost black. In these the legs are nearly all black. It is probable that the nature of the food affects the color. As the berries mature I think the yellow and red colors will prevail to a larger degree.

REPRODUCTION OF THE LICE.

The reproduction of plant lice is very curious. Late in the season we find both sexes. This is the only time that we find males. The sexes now pair, and eggs are laid about buds, in crevices, or where they will best survive the winter. In the spring only females hatch from these eggs. These do not lay eggs, but each gives birth to from three to five lice each day. In about four or five days these young lice begin to produce living lice, each contributing daily its four or five new lice to help on the general devastation. Such early and rapid breeding implies great nutrition, and we easily understand why the plants wither and dry up. We also see how the lice become so quickly numerous and widespread. Calculation shows that in less than a month, if no lice died or were killed, a single louse might be the progenitor of more than several million lice. To follow the number further defies comprehension. Many have written me: "We can not imagine where the lice could come from so quickly and rapidly." The above fact explains this physiological riddle.

WHY SO NUMEROUS THIS YEAR.

This is not the first season that this Aphis avenæ has come like a destroying flood upon the grain fields. In 1861 the lice swarmed upon the cereal

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crops of New England and New York, at which time Dr. Asa Fitch fully described it in his sixth report. In 1866 and again ten years later it did great damage in various sections of the west. We see then that this louse does not come yearly but only at long intervals. Why is this? It is doubtless owing in some measure to the weather, but more to its insect enemies. We readily see that its enormous prolificness would make it as the sands of the sea shore every year, except that some natural agent held it in check. Fitch describes three such enemies. Even now as we visit the oat and wheat fields we find many forms different from any previously described. These have short, rounded bodies, which are of a dirty white color. The cause of this is that these are attacked by parasites, which are eating them up. We have reared several of these little benefactors, and find them now busily engaged in the fields laying the eggs that will destroy the lice. These minute parasitic insects lay a great many eggs, one in each louse, and their presence and prosperity mark the doom of the lice. Thus through the agency of these minute parasitic forms, aided by climatic influences, we are to be saved from a raid by this grain aphis next year, and will be greatly benefited this year. Indeed, in some cases, these little friends will very likely save us from serious damage. Why the parasites are not able to come successfully to the rescue each year is still unknown. Very likely this problem will receive a very valuable practical solution in the future. In these parasites the entomologist sees the doom of the lice, but not, I fear, till great harm is done. Dry weather is a great promoter of insect productiveness. It is more than probable that the exceeding drought of 1887, 1888 and of the April and May just past, together with the mild winter of 1888 and '89, have had much to do with the present invasion. We might expect much aid from our frequent June rains, but I fear they were too late. Observation shows that the lice are more than holding their own, so we may conclude that the warm rains are not greatly depleting their ranks.

WHAT TO EXPECT.

Where the lice are very numerous, as they seem to be over a widespread area of our country, they must do great injury. Where ten or twelve lice are collected about a single kernel of wheat, as I have actually seen in the past few days, there is little hope for that kernel. I have counted one hundred and sixty lice on a single head of wheat. It is hoping too much of the little parasitic flies to expect them to save the present crop. We can but expect much injury, especially where the lice are in such countless numbers as are now seen in many of our wheat fields of Indiana, Ohio and Michigan.

WHAT OF REMEDIES.

The excellent specific against plant louse ravages, the kerosene and soap mixture, cannot be used without much injury to the crop. To apply it might be like the jump from frying pan to fire. Again, the lice are so protected by the close cluster of the kernels that very likely the remedy would not be fully effective. I could not, therefore, recommend its application in this case. We are now making extensive and accurate experiments, so that at time of a future raid we can speak with positiveness in this matter. We are aiming to find just what the damage is, just how many lice it requires

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on a head or kernel to blast it, and just how effective the remedy is, and how serious the damage of its application will be to the plants.

INCORRECT NAME.

The name "green midge," which is going the rounds of the papers, is very incorrect, and should not be used. The Hessian fly and wheat midge are very different insects. These midges are two-winged flies, whose larvæ are footless maggots. They belong to the great two-winged fly order, Diptera, while these are plant lice, or aphides, and belong to the order of bugs, or Hemiptera. Let all speak of this as the grain aphis, or plant louse, and not as the green midge, which is entirely wrong, as they are not always even green in color.

A. J. COOK.

June 27, 1889.

NO. 51—ZOÖLOGICAL DEPARTMENT.

ENEMIES OF THE WHEAT APHIS.

The importance of parasitic and predaceous insects in overcoming our insect pests, has long been recognized by the practical entomologist. He sees the destroyers swept off as by a flood; and sees in these prolific friends the easy solution of the problem of insect years. He knows that were it not for these friends, the destroying hosts would make our earth a desert, and replace plenty with famine. He knows that adversity among these tiny helpers means success to the swarms of insects that devour the crops, and so is rejoiced when he see these little helpers active and numerous.

The present season has furnished a vivid illustration of this important and interesting fact. Ten days ago, June 30, the heads of wheat were crowded with hungry aphides, or plant lice. These myriad lice, often five or six around a single kernel of wheat, and two hundred on a single head, were sucking the sap and very vitality from the forming kernels. They were rapidly blighting the grain, and unless some friendly hand were raised against them the wheat crop would be utterly ruined. Even then, when the lice were countless in numbers, and when the winged forms were rapidly spreading to the oat fields, the hand of deliverance was easily discerned in the comparatively few but wondrously prolific enemies of the lice which had already sounded a halt in the march of destruction. A week later and the enemies of the lice were in the ascendency, and to-day the lice are nearly exterminated, and the wheat crop is rescued and the oat crop saved. Close observation easily demonstrates these truths. Even the careless eye can see the savage insects dining on the lice, or the fatal egg laid which dooms the louse which receives it.

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The fact that farmers are noticing these insect friends, and have now an object lesson which should be rightly understood and carefully studied, leads me to send out this bulletin. Ten days ago I was receiving scores of letters asking about the lice; to-day I am receiving as numerous inquiries regarding these friends. That instruction is opportune is evident from such questions as this: "Are these insects going to complete the destruction so actively begun by the lice?"

BENEFICIAL INSECTS.

There are two groups of these insect friends; predaceous and parasitic insects, both of which are well illustrated on the heads of wheat of our fields to-day. Predaceous insects are such as devour their prey, much as the cat or weasel devours the mouse. Parasitic insects are those that lay their eggs on or in their victims. When these eggs hatch the larval parasite proceeds to feast on its host, which thus serves it for both home and food. In the case before us, as soon as the parasite has devoured the viscera of the louse, it uses the skin or crust as a sort of cocoon. These gray, circular cocoons (Fig. 1) are now thick among the kernels of every head of wheat, and must have been noticed by every observer who has taken pains to examine.

The Wheat Louse Parasite.

This tiny black fly is by far the most important of these littls friends that have come to the farmers' rescue and saved the wheat, barley and oat crops.

The lice that are the victims of these eager parasites are easily distinguished. They (Fig. 1) are short, rounded and gray in color. After the larva disembowels the lice it uses the dry, thick skin as a cocoon, in which it changes to a pupa. Very soon the mature insect comes forth from a small round hole in the upper, hinder part of the abdomen (Fig. 2), and very soon mates and commences to lay its many eggs in new victims. Of course, these parasitic larvæ fairly swim in the rich nutritious blood of the lice, and so are rapidly developed. Thus we see how it is that the parasites are too much for the lice. Prolific as are the lice, and rapid as are they in development, yet the parasites are even more so, and thus it is that in ten days the parasites have so outnumbered the lice that the latter have been routed and driven from the field.

Fig. 1—Parasitized louse.

Fig. 2.—Parasitized louse, showing exit opening.

The little flies are just about one-tenth of an inch in length. They are black above and yellowish brown beneath. The antennæ are black, while the front, mouth parts and legs are yellowish brown. In some specimens the femora and tarsi are dusky, and the under side of the abdomen quite dark. Occasionally we find specimens with the upper part of the abdomen brownish, except the pedicel and tip. There seems much variation in the color of abdomen and legs, though in most cases the dorsal surface is black, and the ventral surface and legs brown. The occiput or collar connecting the head and throax is brown. The antennæ (Fig. 3) are sixteen jointed in the female and seventeen in the male. They are cylindrical, re-

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curved and thickly set with short, light-colored hairs. The first two joints are shorter and larger than the others. The succeeding joints are nearly cylindrical, close together, and equal in length, except the last, which is longer, and conical. The abdomen is lanceolate, and all the segments are freely movable on each other, so it can be easily bent beneath the body. The venation of the wings (Fig. 3) is simple, and the first discoidal cell is incomplete. We see that this parasite is a Braconid, as shown by the simple venation of the wings. The first discoidal cell is incomplete, the abdomen is lanceolate, the antennæ are sixteen or seventeen jointed, and the ventral valves in the female are simple; thus we know it belongs to the genus Aphidius. It differs from Fitch's avenaphis (see Fitch's N. Y., Report, Vol. 6, p. 98), which we also find here now, though far less in number, as that species has nineteen or twenty joints to the antennæ, is honey-yellow instead of brown, the first two joints of the antennæ and the pedicel of the abdomen, and a spot on the suture, between the second and third joints of the abdomen, are honey-yellow, and not black as in this species. The joints of the antennæ are less pedicelated than in avenaphis. If this species is undescribed, A. granariaphis would be a very appropriate name.

Fig. 3.—Adult female greatly magnified.

These tiny flies have been a great factor in ridding our fields of the pestiferous lice. Tiny as they are, they will save millions of dollars to the farmers of Michigan and adjacent States during this single year.

Lady-Bird Beetles.

These beautiful predaceous beetles are very active and most efficient aids in the work of ridding the grain fields of the aphides. Both as larvæ and as mature insects they feed on the plant lice, and rapidly deplete their ranks. The beautiful rounded beetles (Figs. 4, 5, 6 and 7), usually dressed in yellow or orange—we have one species (Fig. 4) which is black with orange dots—and often adorned with black dots and markings, are known and admired by all, though a few have sent me these beetles, asking if they were the Buffalo carpet beetle. Few insects do more good than do these lady-bird beetles. The larvæ of these (Fig. 7) are elongated, dark colored insects usually dotted with gray, yellow or orange, according to the species. The most common one, or at least the one most conspicuous in our wheat fields, is *Megilla maculata.* This one has a broad margin to the first joint back of the head, and two parallel lines on each side which run from above downward, of bright, beautiful orange. So the insect not only does well but looks well. There are also four rows of black dots which extend longitudinally, which are easily seen without a glass. Other species of lady-beetle larvæ are duller in color, and so less conspicuous, yet equally active and voracious. If any doubt the good work of these insects, especially the larvæ, he has but to enclose them in a box with louse infested wheat heads, or with plant lice from any plant. The rapid disappearance of the lice will

Fig 4-Two-spot Lady Beetle.

Fig. 5—Yellow Lady Beetle.

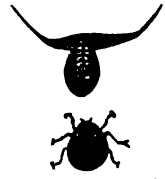

Fig. 6.—Pupa and Beetle.

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quickly convince the most skeptical of the valuable service of these predaceous friends. When full grown the larvæ pupate on a straw or some blade or twig. I have in our collection a cherry twig which contains a score or more of these dark, rounded pupæ. The pupæ (Figs. 6 and 7) are exceedingly small compared with the larvæ and mature beetles. These lady-bird beetles are hardly second to the Braconid parasite, in the work of ridding our grain fields of the lice. Prof. C. M. Weed tells me that he believes in Ohio they take a first place in this important service.

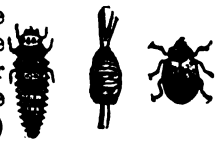

Fig. 7.—Larva, Pupa and Beetle.

The Syrphus-Flies.

By close watching in the wheat or oat fields we observe a large number of very rapid flying two-winged flies. These are not only very quick, but many are lined (Fig. 8) with yellow bands and are very beautiful. These flies, for food, only sip the sweets from flowers, but they lay their eggs on the plants among the aphides, and the maggots that hatch from these are perfect tigers. These syrphus-maggots seem to be veritable gourmands, as the number of plant-lice that one will suck bloodless is surprisingly great. These maggots (Fig. 9) look some like leeches or blood-suckers. The posterior end is large and truncated, while the mouth end is pointed. The color of the young ones is olive green, while the older or more mature maggots are gray, brown or purple. There are light brown transverse bands on the back and one longitudinal one on each side. These maggots creep along in a slug-like manner, ever reaching into every crevice for the lice. The energetic zig zag motion of the head is very interesting. When it first finds a louse it stabs him with its sharp mouth-parts and quickly sucks him bloodless. As the louse shrinks the maggot swells up. No sooner is one louse victimized before another is seized, and thus these voracious maggots will often destroy a half score of lice in quick succession. My students have often suggested that these maggots must have india rubber stomachs. From their great numbers and ravenous appetites we must conclude that these syrphus-maggots are little, if any, behind the Braconid fly and the lady-bird beetles in their good services in helping to save the grain crops.

Fig. 8.—Syrphus-Fly.

Fig. 9.—Syrphus maggot with a plant louse.

Crysopa-Flies.

These beautiful green lace wings, with their brilliant golden eyes (Fig. 10), are no mean factor in this warfare against plant lice. The handsome flies do not feed on the lice but the larvæ do, and as they have insatiable appetites they do excellent execution. These flies lay their minute white eggs

Fig. 10.—Chrysopa-Fly and Eggs.

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on the ends of short hairs (Fig. 10) attached to wheat stems, twigs of fruit trees, in short to any plant that is harboring plant lice. The larvæ (Fig. 11) have strong, sharp jaws, and have well earned the name aphis-lion, which has been aptly applied to them. These and the syrphus-fly maggots work in confinement, or while we are holding the aphis infected plant in our hand. The Braconid fly and the lady-bird beetles, on the other hand, are more timid and quite easily disturbed; and so to see them at work we must approach them with care and handle them without the least jar. Thus in these beneficial insects I have described the little friends that have come to the aid of the farmer and banished disaster.

Fig. 11. Aphis-lion.

A. J. COOK.

July 10, 1889.

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NO. 52—CHEMICAL DEPARTMENT.

COMMERCIAL FERTILIZERS.

In this report of the results of analysis of commercial fertilizers offered or sale in this State during the year 1889, the law requiring inspection of such commercial fertilizers is re-printed for the information of manufacturers, dealers and the public. The law is designed primarily for the protection of the buyer, to insure a quality of goods up to the standard of the manufacturers, and to expose fraud if goods of very inferior quality are placed on the market. Incidentally the law is a protection to the manufacturer, by excluding worthless goods offered as valuable fertilizers. Honest and reliable manufacturers do not complain of this law, for the reason that while it protects the public from fraud, it also protects legitimate trade from ruinous competition with unscrupulous dealers.

The law is very direct and explicit in its terms. Every fertilizer whose retail price exceeds ten dollars a ton requires a license from each dealer, unless the manfacturer secures a license for such sale. Each separate brand of fertilizers requires a license for each year it is sold or offered for sale. It makes no difference on what kind of crop the fertilizer will be used—the farm, garden, or lawn. Nor does the law wait for the manufacturer to establish a profitable trade before it requires a license to sell.

It may seem a hardship to require a dealer who had only sold a few tons of a fertilizer to pay for a license, but the law pays no respect to the amount sold. It would be wise for dealers to inquire of the manufacturer whether he has taken out a license for each fertilizer before he accepts an agency for its sale. The very stringent provisions of section 6 of this law, imposing a fine of at least $100 for selling or offering for sale any such fertilizer without first taking out a license, should warn dealers of the danger of seeking to evade this law. A few are seeking to escape the provisions of this law to their own peril. In justice to honorable and fair dealers, the law must be enforced on all alike.

SESSION LAWS OF 1885.

[No. 26.]

AN ACT to provide for the inspection of commercial fertilizers and to regulate the sale thereof.

SECTION 1. *The People of the State of Michigan enact,* That any person or persons who shall sell or offer for sale in this State any commercial fertilizer, the retail price of which exceeds ten dollars per ton, shall affix on the outside of every package containing such fertilizer a plainly printed certifi-

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cate, stating the number of net pounds therein; the name or trade mark under which such article is sold; the name of the manufacturer; the place of manufacture; and a chemical analysis, stating the percentage of nitrogen in an available form; of potash soluble in water and of phosphoric acid in available form (soluble or reverted) and the insoluble phosphoric acid.

SEC. 2. Before any commercial fertilizer is sold or offered for sale, the manufacturer, importer or party who causes it be sold or offered for sale within this State, shall file with the Secretary of the State Board of Agriculture a certified copy of the analysis and certificate referred to in section one, and shall also deposit with said secretary a sealed glass jar containing not less than two pounds of such fertilizer, with an affidavit that it is a fair sample of the article thus to be sold or offered for sale.

SEC. 3. The manufacturer, importer, or agent of any commercial fertilizer, the retail price of which exceeds ten dollars per ton as aforesaid, shall pay annually to the Secretary of the State Board of Agriculture, on or before the first day of May, a license fee of twenty dollars for each and every brand of fertilizer he offers for sale in this State: *Provided*, That whenever the manufacturer or importer shall have paid this license fee his agents shall not be required to do so.

SEC. 4. All such analyses of commercial fertilizers required by this act shall be made under the direction of the State Board of Agriculture and paid for out of the funds arising from the license fees provided for in section three. At least one analysis of each fertilizer shall be made annually.

SEC. 5. The Secretary of the State Board of Agriculture shall publish in his annual report a correct statement of all analyses made and certificates filed in his office, together with a statement of all moneys received for license fees, and expended for analysis. Any surplus from license fees remaining on hand at the close of the fiscal year shall be placed to the credit of the experimental fund of said board.

SEC. 6. Any person or persons who shall sell or offer for sale any commercial fertilizer in this State without first complying with the provisions of sections one, two and three of this act, or who shall attach or cause to be attached to any such package of fertilizer an analysis stating that it contains a larger percentage of any one or more of the constituents or ingredients named in section one of this act than it really does contain, shall upon conviction thereof be fined not less than one hundred dollars for the first offense, and not less than three hundred dollars for every subsequent offense, and the offender shall also be liable for damages sustained by the purchaser of such fertilizer on account of such misrepresentation.

SEC. 7. The State Board of Agriculture by any duly authorized agent is hereby authorized to select from any package of commercial fertilizer exposed for sale in this State, a quantity, not exceeding two pounds, for a sample, such sample to be used for the purposes of an official analysis and for comparison with the certificate filed with the Secretary of the State Board of Agriculture and with the certificate affixed to the package on sale.

SEC. 8. All suits for the recovery of fines under the provisions of this act shall be brought under the direction of the State Board of Agriculture.

Approved March 10, 1885.

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At a meeting of the State Board of Agriculture held in Lansing, Dec. 1, 1885, the undersigned was appointed the agent of the Board to make the analyses of commercial manures contemplated in the foregoing act. The object of the law is to protect the purchasers and honest manufacturers, and to prevent or to punish fraud in commercial fertilizers.

The specimen for comparison of any fertilizer, with affidavit, and the fee for analysis, must be deposited with the secretary of the Board on or before the first day of May each year.

Any manufacturer or importer who desires to avail himself of the benefits of the proviso in Sec. 3, should notify me of the names of agents selling the fertilizers in this State, and the place where they are offered for sale.

Specimens for analysis will be selected in the open market, and not received from the manufacturer or his agent.

For the sake of uniformity in the certificate required in Secs. 1 and 2 to be affixed to each package of fertilizer, and to be filed with the secretary of the Board, I recommend the following form of certificate:

Name or trademark.....

Name of manufacturer.....

Place of manufacture.....

Net pounds in package..... lbs.

Analysis {
- Percentage of available Nitrogen.....
- Percentage of Potash soluble in water.....
- Percentage of Phosphoric Acid soluble in water.....
- Percentage of Phosphoric Acid reverted.....
- Percentage of Phosphoric Acid insoluble.....

Any inquiries for information or communications on this subject should be addressed to

R. C. KEDZIE,
Agricultural College, Michigan.

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Result of Analysis of Commercial

Manufacturer, and Place Where Made.	Trade Name of the Fertilizer.	Where the Specimen was Selected and Name of Dealer.
Cleveland Dryer Co., Cleveland, O.	Sandy Soil Fertilizer	S. B. Spencer, Holloway
Cleveland Dryer Co., Cleveland, O.	Ohio Seed Maker	S. B. Spencer, Holloway
Cleveland Dryer Co., Cleveland, O.	Potato Fertilizer	E. W. Spencer, Petersburgh
Cleveland Dryer Co., Cleveland, O.	XXX Acid Phosphate	E. W. Spencer, Petersburgh
Cleveland Dryer Co., Cleveland, O.	Buckeye Ammoniated Bone-Super-Phosphate	B. E. Niles, Blissfield
Cleveland Dryer Co., Cleveland, O.	Ammoniated Dissolved Bone	E. W. Spencer, Petersburgh
Cleveland Dryer Co., Cleveland, O.	Square Bone	E. W. Spencer, Petersburgh
Cleveland Dryer Co., Cleveland, O.	Superior Bone	E. W. Spencer, Petersburgh
Crocker Chem'l Co., Buffalo, N. Y.	Queen City Phosphate	Manufactory
Crocker Chem'l Co., Buffalo, N. Y.	Buffalo Super-Phosphate (No.2.)	Holcomb Brothers, Bay City
Crocker Chem'l Co., Buffalo, N. Y.	Ammoniated Bone Super-Phos.	Manufactory
Crocker Chem'l Co., Buffalo, N. Y.	Vegetable Bone Super-Phos.	Mich. Implement and Machine Co., Jackson, Mich.
Crocker Chem'l Co., Buffalo, N. Y.	New Rival Ammoniated Super-Phosphate	J. R. Carpenter, Blissfield
Crocker Chem'l Co., Buffalo, N. Y.	Wheat and Corn Ammoniated Phosphate	Manufactory
Crocker Chem'l Co., Buffalo, N. Y.	Potato, Hop and Tobacco Phos.	Mich. Implement and Machine Co., Jackson, Mich.
Crocker Chem'l Co., Buffalo, N. Y.	Pure Ground Bone	Manufactory
Northwest'n Fertil'g Co., Chicago.	826 Phosphate	Bialy & McDonell, Bay City
Northwest'n Fertil'g Co., Chicago.	Prairie Phosphate	C. A. Slayton, Tecumseh
Northwest'n Fertil'g Co., Chicago.	Garden City Super-Phosphate	C. A. Slayton, Tecumseh
Northwest'n Fertil'g Co., Chicago.	Celery Grower	Stevens & Mott, Benton Harbor
Northwest'n Fertil'g Co., Chicago.	Fine Raw Bone	C. A. Slayton, Tecumseh

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Fertilizers in Michigan for 1889.

Composition of Fertilizers as Claimed by Manufacturer and as Found on Chemical Analysis. Percentage Estimation.

	Nitrogen.		Phosphoric Acid, P_2O_5.				Potash Soluble in Water.	
			Available P_2O_5.					
	Total Active.	Equal to Ammonia.	Soluble P_2O_5.	Reverted P_2O_5.	Insoluble P_2O_5.	Total, P_2O_5.	Equal to Oxide, K_2O	Equal to Sulphate, K_2SO_4.
Claimed		3 to 4	9	to 11		10 to 13	2 to 4	
Found...	.86	1.05	9.51	1.52	4.16	15.19	.77	1.40
Claimed		1½ to 2½	10	to 12		15 to 17	0	0
Found...	1.12	1.36	8.31	1.08	4.28	13.67		
Claimed		4 to 5	8	to 10		10 to 14	4 to 6	
Found...	1 05	1.29	8.28	2.36	3.07	13.66	1.77	3.28
Claimed	0	0	14	to 15		15 to 16	0	0
Found...			11.51	1.49	3.16	16.16		
Claimed		3 to 4	9	to 10		11 to 12	1 to 2	
Found...	2.00	2.43	7.93	2.09	3.88	13.90	.27	.50
Claimed		1½ to 2½	10	to 12		15 to 16	0	0
Found...	1.00	1.22	7.48	1.80	3.80	13.08		
Claimed		3 to 4	6	to 10		20 to 25	0	0
Found...	3 23	3.73	5.76	3.33	7.93	17.02		
Claimed		4½ to 6	0	0		22 to 25	0	0
Found...	3.70	4.50				22.36		
Claimed		2 to 2½	6 to 8	2 to 4	1 to 2	9 to 14		2 to 4
Found...	1.86	2.26	9.38	.95	1.18	11.51	2.70	5.00
Claimed	0	0	10 to 11	1 to 3	1 to 2	12 to 15	1 to 2	2 to 4
Found...			11.80	2.91	2.51	17.22	1.35	2.50
Claimed		3½ to 4½	10	to 12	1 to 2	11 to 14		2 to 3
Found...	3.33	4.05	9.22	2.42	2.14	13.78	1.80	3.33
Claimed	5 to 6	6 to 7	6	to 7	1 to 2	7 to 9	6 to 8	11 to 15
Found...	3.92	4.76	3.67	1.57	2.4	7.64	7.40	13.70
Claimed		1½ to 2½	10	to 12	1 to 3	11 to 15		3 to 5
Found...	1.75	2.12	8.31	.92	1.57	10.80	1.96	3.63
Claimed		2½ to 3½	10	to 13	1 to 2	11 to 15		3 to 5
Found...	2.42	2.94	5.92	3.84	1.91	11.67	2.73	5.05
Claimed		2½ to 3½	10	to 12	1 to 2	11 to 14		6 to 8
Found...	1.94	2.35	8.37	1.87	1.76	12.50	3.90	7.44
Claimed		3½ to 4	0	0		25.	0	0
Found...	4.75	5.76				25.40		
Claimed		1½ to 2	6	to 8	7 to 9	13 to 17	0	0
Found...	2.40	2.90	5.60	5.59	4.32	15.51		
Claimed		1½ to 2	6	to 8	9 to 11	15 to 19	0	0
Found...	1.71	2.08	4.80	5.06	5.41	15.27		
Claimed		2½ to 3	4 to 4½	4 to 4½	2 to 3½	10 to 12½	.54 to 1.08	
Found...	2.25	2.73	5.83	1.79	4.64	12.26	.48	.90
Claimed		3 to 4	7	to 9				2 to 3
Found...	2.87	3.48	4.64	2.75	6.20	13.59	1.48	2.74
Claimed		3 to 4	0	0	23 to 25		0	0
Found...	3.80	4.60			24.54		0	

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Results of Analysis of Commercial Fertilizers

Manufacturer, and Place Where Made.	Trade Name of the Fertilizer.	Where the Specimen was Selected and Name of Dealer.
Michigan Carbon Works, Detroit.	Homestead Super-Phosphate...	Warehouse of Manufacturer...
Michigan Carbon Works, Detroit.	Jarves Drill Phosphate.....	Warehouse of Manufacturer...
Bradley Fertilizer Co., Boston, Mass.	Bradley's Dissolved Bone with Potash.....	T. J. Sutton, Sutton.....
Bradley Fertilizer Co., Boston, Mass.	B D Sea Fowl Guano.....	T. J. Sutton, Sutton.....
Lister's Agr'l Chemical Works, Newark, N. J.	Lister's Success Phosphate.....	Davis Brothers, Jackson, Mich.
Walton & Whann Co., Wilmington, Del.	Diamond Soluble Bone.....	S. M. Isbell & Co., Jackson.....
Walton & Whann Co., Wilmington, Del.	Diamond Soluble Bone and Potash.....	Manufacturer.....
W. S. Dunbar, St. Joseph, Mich....	Fish Fertilizer.....	Manufacturer.....
W. S. Dunbar, St. Joseph, Mich....	Bone and Meat Fertilizer.....	Manufacturer.....
The Farmer's Fertilizer Co., Detroit, Mich.	Farmers' Fertilizer.....	Samuel Kerr & Co., Detroit.....
Anti-Kalsomine Comp'y, Grand Rapids, Mich.	Church's Bug Finish.....	Manufacturer.....
Western Union Chemical Co., Cleveland, O.	Empire Super-Phosphate.....	Manufacturer.....
Western Union Chemical Co., Cleveland, O.	International Super-Phosphate	I. W. Hicks, Richmond.....
Northwestern Chemical Co., Milwaukee, Wis.	.....	John Muller, Warren.....
Western Reserve Fertilizer Co., Mineral Ridge, O.	Western Reserve Fertilizer....	P. J. Abfalter, Lansing.....

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in Michigan for 1889.—CONTINUED.

Composition of Fertilizers as Claimed by Manufacturer and as Found on Chemical Analysis. Percentage Estimation.

	Nitrogen.		Phosphoric Acid, P_2O_5.				Potash Soluble in Water.	
			Available P_2O_5.					
	Total Active.	Equal to Ammonia.	Soluble P_2O_5.	Reverted P_2O_5.	Insoluble P_2O_5.	Total, P_2O_5.	Equal to Oxide, K_2O.	Equal to Sulphate, K_2SO_4.
Claimed.	1.85 to 2.40	2.25 to 3.15	7 to 10	1	.50 to 1.50	8.5 to 11.5	.....	2.75 to 3.50
Found...	2.46	2.99	7.65	.37	2.24	10.26	1.68	3.10
Claimed.	.....	1¼ to 2	7 to 8	½ to 1½	2 to 3	10 to 12	0	.....
Found...	1.16	1.41	7.14	1.33	2.27	10.74	0	.....
Claimed.	.....	1 to 2	6 to 8	2	.....	10 to 12	.....	4 to 6
Found...	1 13	1.38	8.63	1.09	2.43	12.15	1.94	3.60
Claimed.	.....	2.5 to 3 5	6 to 8	2	.....	10 to 12	1.5 to 2.5	2.75 to 4.75
Found...	2.17	2.63	8.63	1.77	2.40	12.80	1.12	2.08
Claimed.	.....	1¼ to 2	10.50	to 12.00	.....	.....	.....	1½ to 2
Found...	1.65	2.17	7.75	1.44	4.64	13.83	1.15	2.12
Claimed.	.....	½ to 1	13	to 15	1 to 3	14 to 18	0	0
Found...	.35	.43	9.11	2.84	3.95	15.90	.....	.....
Claimed.	0	0	13	to 15	1 to 3	14 to 18	2¾ to 3¼	.....
Found...	.....	.....	8.00	.40	7.35	15.75	2.36	4.40
Claimed.	6.75	8.19	0	0	.....	14.00	0	.....
Found...	5.67	6.88	.....	.....	.....	13.78	.....	.....
Claimed.	6.24	7.58	0	0	.....	16.	0	.....
Found...	4.78	5.80	.....	.....	.....	14.52	.....	.....
Claimed.	.....	2½ to 3¼	.....	.....	.....	8 to 11	.....	2¾ to 3½
Found...	2.45	2.97	2.02	1.60	1.05	4.67	.54	1.00
Claimed.	0	0	.....	.....	.....	?	0	0
Found...	.....	.....	.....	.....	.....	.10	.....	.....
Claimed.	.....	1¼ to 2½	9	to 12	3 to 5	12 to 17	0	0
Found...	.....	1.83	10.09	.....	4.09	14.18	0	0
Claimed.	0	0	12	to 14	2 to 4	14 to 18	0	0
Found...	0	0	12.80	.....	3.20	16	0	0
Claimed.	.....	2.63	8	to 10	.....	.....	.....	1 to 2
Found...	.....	2.52	6.75	.....	5.75	12.50	.....	trace
Claimed.	0	0	.....	trace	to	2.00	trace	to 2.00
Found...	0	0	.....	trace	.....	.....	.....	.23

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NO. 53.—ENTOMOLOGICAL DEPARTMENT.

SPRAYING WITH THE ARSENITES.*

MR. PRESIDENT—

Nine years ago, at the first meeting of this society, I presented a paper upon the use of Paris green as a specific against the codling moth.

In that paper I gave the results of careful and elaborate experiments, which settled two facts that were very important in economic entomology: First, that Paris green was efficient as a preventive of the ravages of the codling larva; and secondly, that such use was entirely safe in respect to poisoning the fruit. Today, less than a decade from the date of the discovery of this remedy, this method to combat the worst insect pest of the apple grower is generally adopted by the more intelligent orchardists of our country. Its value is now universally conceded. Easy and cheap methods to apply the insecticide are now known and generally adopted.†

For several years myself and others have been experimenting, in hopes to find that this same insecticide was equally efficient to destroy the plum curculio. For six or seven years I have sprayed plum trees once and even twice with no apparent good. Test trees, close beside the trees sprayed, and that were not treated, were as free from attack as were the trees that were sprayed, and the trees treated were no more exempt from attack than the others. Thus I was convinced that this insecticide was of no value in this curculio warfare. Several of my horticultural friends, in whose ability to experiment and observe correctly I had great confidence, had tried this remedy with *very satisfactory* results. In 1888 I studied this matter very closely, and concluded that as the plum is a smooth fruit, with no calyx cup like that of the apple, in which the poison may lodge, and as the curculio lays its egg anywhere on the smooth rind, the poison would be very easily washed off, or even blown off by the wind. I thus concluded that my want of success was very likely due to a want of thoroughness. In 1888 I sprayed certain trees three times, at intervals of eight days, and omitted to treat other trees close alongside. The benefit from spraying was very marked.

I also found that carbolized plaster—one pint of crude carbolic acid to fifty pounds of plaster—was quite as efficient to repel the curculio as was the arsenites. This was also applied three times. The season was very dry, and there were few or no rains to wash off the insecticides. This year I repeated the experiments both with the London purple and with the carbolized plaster, but with no success. All the trees were severely attacked, and all the plums lost. This year we had almost daily rains, which were frequently quite severe.

* Read at Toronto, August 26, before the Society for the Promotion of Agricultural Science.

† A very cheap and excellent pump, not mentioned in Bulletin No. 39, issued by the Michigan Experiment Station, of last year, is the Brooks Brass Hand-force Pump, and is sold for $2.00, by Mr. J. K. Compton, Leslie, Michigan. For a few trees it serves very well.

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I believe I am warranted in the following conclusions: The arsenites and carbolized plaster will protect against the plum curculio if they can be kept on the tree or fruit. But in case of very frequent rains the jarring method will not only be cheaper, but much more effective. Again, as our wild fruits are more cleared away we must have plums in our orchards to protect the apples from the curculio. When apples are seriously stung they become so gnarled and deformed as to be worthless. It will pay, then, to set plum trees near by or among the apple trees. Then we will escape mischief among our apples from the curculio, and will only need to spray our apples once, to destroy the codling moth, and can treat the plum trees three or four times with Paris green or carbolated lime in case we have only occasional showers, or can jar the trees when the rains are very frequent. For the apples we can use London purple, one pound to 200 gallons of water. For the plums we must use Paris green, one pound to two or three hundred gallons of water. If the carbolated plaster is preferred, we use one pint of crude carbolic acid to fifty pounds of land plaster. This is thrown freely over the trees, so as to strike every plum on the tree which is being treated.

Another very important practical point has been suggested by the past season's experience with these insecticides: I refer to the danger of applying them before the blossoms fall. Bees are quite as susceptible to these poisons as are the codling larvæ and curculio. In their good work of collecting nectar and fertilizing the blossoms, they are very certain to take the poison as well, if the trees have been sprayed. Of course there is no excuse for spraying at so early a date, as neither the curculio or codling larvæ commence their attack till the blossoms fall. Thus for the object in mind, as well as for the safety of the bees, delay should be insisted upon. I think we, as scientists and all educated men, should pronounce vehemently and with one voice against spraying our fruit trees with the arsenites till the blossoms have all fallen. We should even go farther. We should secure the enactment of laws which would visit any such offense with fine and imprisonment. Such laws would prove a ready and active educator.

In the past season many bee keepers have lost severely from the neglect of their fruit growing neighbors to observe this caution. I will only mention two cases. Mr. John G. Smith, Barry, Illinois, writes: "One of my neighbors, owning an orchard of about one hundred acres of apple trees, sprayed the trees with Paris green and water just as they were in full bloom. The result is that ten or twelve bee keepers are ruined." The imago no less than the larvæ and pupæ were destroyed. Mr. J. A. Pearce, Grand Rapids, Mich., was also a heavy loser from the same cause. His bees likewise died in all stages of development.

It is well to remember and to urge that this loss is not confined to the bee keeper, for the fruitgrower as well as the apiarist needs the bees and their work to insure his best success. It only requires, then, that our people know the truth to insure against loss in this direction.

INJURY TO THE FOLIAGE.

Another practical question of no small moment in this use of the arsenites refers to injury to the foliage of the trees treated. In an elaborate series of experiments the past season, we desired to learn the effect on different trees

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of the different arsenites, and whether the date of treatment and atmospheric condition had any influence. The following is a tabulated statement of the experiments:

Date.	Variety Treated.	Poison Used.	Date of Second Application.	Time after Treatment	Weather.	Effect.
May 20..	6 plum trees...	Lon'n p'ple 1 lb. to 200 gal.	June 5....	Ten days	Rain 21, 23	No injury.
May 20..	2 cherry trees..	" " "	"	"	"	" "
May 21..	4 apple "	" " "	May 23....	"	"	" "
May 23..	5 cherry "	" 1 lb to 150 gal.	"	"	"	" "
June 7...	3 willow "	" 1 lb to 100 gal.	June 13...	"	.....	" "
June 7..	3 elm "	" " "	" ...	"	.....	Some.
June 7...	3 h. maple "	" " "	" ...	"	.....	"
June 7...	5 apple "	" " "	" ...	"	.....	"
June 7...	5 cherry "	" " "	" ...	"	.....	None.
June 7...	5 plum "	" " "	" ...	"	.....	Some.
June 12..	3 elm "	" " "	June 17...	"	.....	Much.
June 12..	3 plum "	" " "	" ...	"	.....	"
June 12..	3 apple "	" " "	" ...	"	.....	"
June 12..	3 cherry "	" " "	" ...	"	.....	None.
June 24..	3 apple "	" " "	.....	"	Rain 25th	Very bad.
June 24..	3 peach "	" " "	.....	"	"	" "
June 24..	3 plum "	" " "	.....	"	"	" "
July 5...	5 peach "	" 1 lb. to 200 gal.	.....	Five days	.....	Great injury.
July 8...	2 peach "	" " "	.....	"	.....	" "
July 8...	1 cherry "	" " "	.....	"	.....	Slight.
July 8...	1 pear "	" " "	.....	"	.....	Some.
July 10..	1 pear "	" " "	.....	"	.....	"
July 10..	3 peach "	" " "	.....	"	.....	Very bad.
July 10..	1 plum "	" " "	.....	"	.....	Quite bad.
July 11..	2 peach "	Paris gr'n, 1 lb. to 100 gal.	.....	"	.....	Slight.
July 11..	2 peach "	" 1 lb. to 200 gal.	.....	"	.....	None.
July 11..	2 peach "	" " 250 gal.	.....	"	.....	"
July 11..	2 peach "	" " 300 gal.	.....	"	.....	"
July 11..	2 peach "	London purple water.....	.....	"	.....	Great injury.
July 15..	3 peach "	W'te ars'ic 1 lb. to 300 gal.	.....	"	.....	" "
July 15..	3 peach "	Lon'n p'ple 1 lb. to 200 gal.	.....	"	.....	" "
July 15..	3 peach "	Solution analine.....	.....	"	.....	None.

I think we are warranted in the following conclusions: First, London purple is more injurious to the foliage than is Paris green; and white arsenic—aresenious acid—is more harmful than is either London purple or Paris green. This is doubtless owing to the soluble arsenic which is quite

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abundant in London purple, and almost absent in Paris green. In experiment No. 29 (See table) it will be noticed that the colored water after London purple fully settles is very destructive to foliage, while analine (See experiment No. 32) is not at all harmful. This agrees with the experiments of Prof. C. P. Gillette, made in 1888, where white arsenic was found very destructive to foliage.

Secondly, Peach foliage is especially susceptible to injury, and cherry foliage the least so of any of the kinds treated.

Thirdly, It would seem that London purple and white arsenic, used just before a rain, are more harmful than when used during a drought. We not only saw greater injury when a rain followed spraying within two or three days, but secured the same results by spraying, soon after treatment, with pure water. This also accords with the view that the injury comes from the presence of soluble arsenic.

Fourthly, It would seem that spraying soon after the foliage puts out is less harmful than when it is delayed a few days, or better, a few weeks. For ten years I have sprayed both apple and plum trees in May, and for several years with London purple, and often used a mixture as strong as one pound to one hundred, or even fifty gallons of water. Yet in most cases no damage was done. This year I sprayed several trees in May, using one pound to 100 gallons of water with no damage. In June and July spraying the same trees with a mixture only one-half as strong did no slight injury. This fact, if fact it be, accounts for the few reports of injury in the past, even with a stronger mixture, and the frequent reports of damage within a year or two, even with a dilute mixture. Then the spraying was confined to May; now it reaches to June, or even to July.

Fifthly, London purple may be used on apple, plum, cherry, pear, and most ornamental trees, but on these should never be stronger than one pound to two hundred gallons of water. If the application is to be repeated, as it must be for the curculio, to prove effective, or if it is to be used in June or July, Paris green should be used, in the same proportion as above, or else we should only use one pound of London purple to three hundred gallons of water. I now think that this necessity is more due to time of application than to the fact of increased quantity of the poison.

Sixthly, If the arsenites are to be used on the peach, to defend against the curculio, Paris green only should be used, and that not stronger than one pound to three hundred gallons of water. With the peach the poison is not only absorbed, coloring the tissue purple or brown, but even the petiole or stem of the leaf is weakened, and the leaf falls. Thus in several cases where we used London purple, one pound to two hundred gallons of water, or white arsenic, the peach leaves all fell off. White arsenic colors the tissue the same as does the London purple, showing once more that it is the soluble arsenic, not analine, that does the mischief.

Seventhly, The injury done to the foliage is never immediately apparent. It usually shows somewhat the second day, but the full injury is frequently not manifest till the fifth day, and often not till the tenth.

POISONING THE PASTURE UNDER THE TREES.

Another important practical question which I have tried to settle this season—1889—concerns the danger of pasturing under trees which have been sprayed with the arsenites.

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A gentleman wishing to spray his orchard, in which he was pasturing seventy-five hogs, consulted me as to the wisdom of doing so without first removing the swine. I told him I believed there was no danger. I said use a mixture, one pound of London purple to two hundred gallons of water, watch your hogs closely and if any seem affected remove all at once, and I will be responsible for damages to the amount of twenty-five dollars. The gentleman did so and reports no damage.

In the following experiments I used the mixture of twice the strength which should be used, that the experiments might be the more convincing. I used one pound to one hundred gallons of water. In every case the spraying was very thoroughly done. Care was taken that every twig and leaf should be drenched.

In tree No. 1 a thick paper was placed under one-half of a rather small apple tree. The space covered was six by twelve feet, or seventy-two square feet. The paper was left till all dripping ceased. As the day was quite windy the dripping was rather excessive. In this case every particle of the poison that fell from the tree was caught on the paper. Dr. R. C. Kedzie analyzed the poison and found four-tenths (.4) of a grain. Tree No. 2 was a large tree with very thick foliage. Underneath this tree was a thick carpet of clover, blue grass and timothy just in bloom. The space covered by the tree was fully sixteen feet square, or equal to two hundred and fifty-six square feet. As soon as all dripping had ceased, the grass under the tree was all cut very gently and very close to the ground. This was taken to the chemical laboratory and analyzed by Dr. R. C. Kedzie. There was found 2.2 grains of arsenic. Now, as our authorities say that one grain is a poisonous dose for a dog, two for a man, ten for a cow, and twenty for a horse, there would seem to be small danger from pasturing our orchards during and immediately after spraying, especially as no animal would eat the sprayed grass exclusively. To test this fully, I sprayed a large tree over some bright tender grass and clover. I then cut the clover carefully, close to the ground, and fed it all to my horse. It was all eaten up in an hour or two, and the horse showed no signs of any injury. This mixture, remember, was of double the proper strength, was applied very thoroughly, and all the grass fed to and eaten by the horse. This experiment was repeated with the same result. I next secured three sheep. These were kept till hungry, then put into a pen about a tree under which was rich, juicy June grass and clover. The sheep soon ate the grass, yet showed no signs of any injury This experiment was repeated twice with the same result. It seems to me that these experiments are crucial and settle the matter fully. The analyses show that there is no danger, the experiments confirm the conclusion.

Thus we have it demonstrated that the arsenites are effective against the codling moth, that in their use there is no danger of poisoning the fruit, and when used properly no danger to the foliage, nor to stock that may be pastured in the orchard.

A. J. COOK.

August 17, 1889.

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NO. 54.—BOTANICAL DEPARTMENT.

EXPERIMENTS AND OBSERVATIONS ON THE JACK-PINE PLAINS.

At the close of the second growing season of the plats at the experiment stations on the sandy plains, pressing inquiries are made as to "what are the prospects so far as you have gone?"

Perhaps unwisely, I venture to offer this bulletin on the subject, though it is too soon to attempt to give very decided results.

Most of the work so far done has been undertaken with the view of obtaining some clues for making more extended and thorough experiments. The tests so made are mostly crude, indefinite, and lack exactness. I have no specific data founded on exact weights and measurements.

My former report to the Director of the Experiment Station, not yet printed, contains some statements which would be interesting in this connection.

Owing to the distance from the College, and the time and expense required, I have only visited the stations all around four times in 1888, and three times in 1889. Could the plats be seen oftener, and could more careful oversight of the labor be secured, I might have made more rapid progress in some directions.

In many respects, none of us know just what are the most promising experiments. We are doing some preliminary work, and must, for the sake of economy, take a little time to learn the best course to pursue.

At the close of the first summer, I should have judged that the common locust was the most promising tree to attempt to grow on the sands of Northern Michigan, but after six months of winter, when nearly every tree was dead, root and branch, I must change my opinion. Other illustrations could be given.

No two seasons are exactly alike, and over these we have no control. Cutworms in one place, as at Grayling last spring, may devour nearly all the growing crops, but not be very troublesome in most other parts of the State. Hence the wisdom of trying similar experiments in several different parts of the State. An accident may occur in conducting one experiment, but if others are performed as intended, results may be reached.

With this explanation, I will venture to give some opinions as to the probable meaning of the tests so far made, though time may show that mistakes have been made. I make no promise to adhere to opinions here expressed with a view to being consistent.

The opinions given are based on the experiments I have made during the past two years, on some things observed with reference to experiments made at Grayling by my colleague, Dr. Kedzie, on answers to inquiries put to many persons in various parts of the State, and on observations made in many places.

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It will be remembered that I am making experiments at Oscoda, Iosco county; Grayling, Crawford county; Baldwin, Lake county; Walton, Grand Traverse county, and Harrison, Clare county.

At Grayling the results so far attained with young forest trees are given in my last report for June, 1889. At this station I have tried for one year, or in many cases for two years, a very large number of kinds of grasses and other forage plants on small plats a rod square. These tests were made on land which had been cropped for several years, without much, if any, fertilizing. At Harrison, for one year, I tried about a quarter of an acre of each, in 1888, of spurry, rye, sweet clover, peas, alsike clover, red clover, mammoth clover, alfalfa, perennial rye grass, Italian rye grass, meadow fox-tail, orchard grass, tall oat grass, Timothy, Hungarian grass, German millet, June grass, meadow fescue, a mixture of one-fourth acre of tall oat grass and orchard grass; another of perennial rye grass and mammoth clover; another of orchard grass and mammoth clover; another of a mixture of mammoth clover, red clover, alsike clover, tall oat grass, orchard grass, perennial rye grass, June grass, meadow fox-tail and Timothy.

The above tests at Harrison were made on land which had been successively cropped for six years, without manure or seeding to grass or clover.

These tests at Grayling and at Harrison, added to what I have learned from many other sources, satisfy me that it is a hopeless task to attempt to find any grass or other forage crop, any grain or fruit or vegetable which can be *profitably* grown without the aid of some fertilizer. An exceptionally favorable season might now and then be found, at wide intervals, when such crops might do very well, but they could not be relied on for profitable farming.

On such land, to produce anything worth while, some fertilizer or irrigation I believe to be indispensable. I am not yet prepared to say what fertilizers would prove most profitable, or whether, even with fertilizers, there would be a profit.

The above statements are not intended to apply at present to new land just broken up, or land which has been generously treated. The quality of the land selected for experimenting may be graded about as follows: Oscoda poorest, then that at Grayling, then Walton and Baldwin much alike, Harrison best of all.

The land of each station is jack-pine plains, and may safely be graded as thin, light, or poor, in the ordinary acceptance of these terms. The botanist finds the smallest number of species of wild plants growing on the poorest land; for example, a smaller number on the plats at Oscoda than on those at Harrison.

On the land newly broken, in the spring of 1888, at Oscoda, Walton, Baldwin and Harrison, the size of the plats and the seeds sown on each are essentially a repetition of each other; the seeds are the same as those above named as sown on the old field at Harrison.

It is very interesting to watch these experiments. Something new occurs to me on every visit; as to what to sow, the modes of sowing, time of sowing, modes of cultivating and treatment of the land.

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PLATS AT WALTON.

Below a plan of the plats is shown as made in the spring of 1888. The land had been cleared and fenced. It was well plowed and harrowed and rolled; the rolling was done after the seeds were sown. The land appears to be of even quality, and is nearly level. From May 7 to August 4, 1888, was a very dry season; the spring of 1889 was moister and favorable for the starting of seeds. During the year 1888 no fertilizers of any kind were used. The eight sorts sown in three places were fowl meadow grass, orchard grass, Timothy, tall oat grass, perennial rye grass, meadow foxtail, red clover, and mammoth clover.

27.—Blank. Plowed not sown.	26.—Hungarian. Sown about May 20. Sown to red clover late in Aug.	25.—Rye. Sown about May 20. Sown to red clover late in August.	
24.—Meadow fescue. Sown about May 20.	23.—Millet. Sown about May 20. Sown to red clover late in August.	22.—Alfalfa. Sown about May 20.	
21.—Alsike clover. Sown about May 20.	20.—June grass. Sown May 11.	19.—Eight sorts. Sown May 11.	
18.—Timothy. Sown May 11.	17.—Italian rye grass. Sown May 11.	16.—Spurry. Sown May 11.	9.—Left wild.
15.—Perennial rye grass. Sown May 11.	14.—Meadow foxtail. Sown May 11.	13.—Field peas. Sown May 11. Sown to orchard grass late in August.	
12.—Mammoth clover. Sown May 11.	11.—Red clover. Sown May 11.	10.—Sweet clover. Sown May 11.	
8.—Orchard grass. Sown May 11.	7.—Tall oat grass. Sown May 11.	6.—Orchard grass. Sown May 11.	5.—Unplowed, not harrowed. Seven sorts. Sown May 11.
4.—Orchard grass. Sown May 11.	3.—Tall oat grass and orchard grass. Sown May 11.	2.—Mammoth clover and orchard grass. Sown May 11.	1.—Unplowed, but harrowed. Seven sorts. Sown May 11.

On October 18, 1888, the following notes were made: No. 1, a very little small grass seen; No. 2, rather small, mostly thick enough, two or three inches high; No. 3, nice and even, though short; Nos. 4, 6, 8, look well, three inches high; No. 5, nothing seen of seeds sown; No. 7, thin, spotted, slim, some stems six inches high; No. 9, left without cultivation; No. 10, pale, thin, large roots; No. 11, a poor catch, some of it has gone to seed; No. 12, thicker and better than red clover; No. 13, a very small crop left and land sown to orchard grass late in August; No. 14, exceedingly thin, a very poor catch, probably the seed was poor; No. 15, better than Timothy,

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none with flowering stems; No. 16, thick, one foot high, freely seeding, some seed sprouting on the ground; No. 17, better than perennial rye grass, some of it has seeded; No. 18, Timothy thin and very light, no stems with spikes; No. 19, thick, even, not quite so large as some; No. 20, none seen; No. 21, appears too thin, must be seeded over; No. 22, spindling, very stout roots, hard to pull by hand, thin, promising; No. 23, very thick, some of it one and a half feet high, much of it eight inches; No. 24, scattering, some good patches; No. 25, thin, two and a half feet high, spikes short; No. 26, about like the German millet.

The rye, Hungarian and millet were cut and taken off. The clover sown on that ground was not harrowed. Wild sweet ferns and brakes and other wild plants were rather common all over the plats.

The following operations were performed in 1889: In April, a thick top-dressing of good old barnyard manure was spread on the east end of each plat, extending over a space about twenty feet square. At the same time two quarts of Homestead superphosphate was sown on a similar space near the middle of each plat. Number 7 was reseeded with tall oat grass, number 14 was seeded to red clover, number 18 was reseeded to Timothy, meadow fescue was reseeded on number 24, alsike clover seeded on number 21, June grass on number 20. Number 27 was harrowed, sown to red clover and rolled. On July 11 a strip of new land two rods wide along the east end of the plat was broken up as shallow as it could well be plowed. The intention is to backset it and seed in spring. In October, when visited, this piece was quite clean, only a few wild plants having grown up through the furrows.

On October 16, at the close of the second growing season, the following notes were taken:

The spring was very dry till near the end of May, but wet and cool in June, favorable for young grass and clover. Where the seven sorts were sown two years ago, without harrowing or plowing, there is rarely anything to show for it. The seed sown where the new land had simply been harrowed is coming on quite well, as though in time it might amount to something. Those most prominent are orchard grass, oat grass, Timothy and the clovers. Number 2, mammoth clover and orchard grass sown a year ago last spring, well seeded, clover making the most show, excepting where the barnyard manure was spread; there the orchard grass has made the most progress and crowded the clover. In all cases, so far as can be seen, the barnyard manure helps the true grasses more than it helps the clovers, while the superphosphate has helped the clovers more than the true grasses. The benefit of superphosphate to the clover is very marked and unmistakable. Number 3, tall oat grass and orchard grass: the manure helps; can't see as superphosphate has been any benefit; a very good show, two to three feet high. Both have seeded and the seed has fallen and is coming up in places. This is better than a plat next to it where tall oat grass was sown alone. Numbers 4, 6, 8, orchard grass: Short; the manure helps it; can't see as superphosphate did; not very many stems have gone to flower and seeded. Number 7, tall oat grass: Mostly sown a year ago last spring; rather thin, not so good as where something else is sown with it. Number 10, sweet clover: This was eaten by cut worms in spring, as I suppose other plants were to some extent; the plants are very scattering, slim, two feet or more high, seeded, now nearly all dead; this plant is of no account so far as I can

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see. Number 11, red clover sown a year ago last spring: There is not so much on the ground as where orchard grass or tall oat grass were added; not so promising as mammoth clover. Number 12, mammoth clover: Manure has helped it considerably; superphosphate still more. Number 13, orchard grass, sown in August of 1888, after peas, without harrowing or rolling, nearly a failure; no show: Number 14, meadow foxtail: A little scattering; two and one-half feet high on the east end; seed ripened and fallen and growing; most of plat is too thin to be of any value; this is the great trouble with meadow foxtail everywhere; the seeds are often poor, or the chaff fails to fill. Number 15, perennial rye grass: Even, rather thin, twenty inches high, seeded, seed fallen and now coming up; manure helps it. Number 16, spurry: In spring, patchy, very small; manure helps it; in October, nearly all gone; little in sight; of no account. A similar statement may be made of the plats in Oscoda and Baldwin. Number 17, Italian rye grass: Pretty good, better than rye grass; two feet high; seeded; fallen seeds growing; the old plants may be expected to all die this winter; we shall see. Number 18, Timothy: Thin; two and one-half to three feet high; seeds have fallen and are growing. Number 19, a mixture of eight sorts noted above: Thicker than any other plat; well seeded, even; manure helps grasses some; superphosphate the clovers. Number 20, June grass: But very little seen; of the first seeding some has seeded. This grass has so far in other places only caught in a very few spots. Number 21, alsike clover: Stems spreading or bending over; covered with bees in June; a very good show, taking the eye of visitors as well as anything; weeds not so plenty here as in most other places; plants really are rather thin; seeding very freely; manure helps it, superphosphate helps it still more. After all the show, I question whether mammoth clover and orchard grass or this clover in other mixtures would not yield more hay. Number 22, alfalfa or lucerne: Spindling, with narrow tops and stout roots; ten to twelve inches high; rarely any went to seed; the plat is very weedy; it doesn't so far look as though it would be worth much, for the cold, short summers of this part of the State. The same may be said of the plats at Baldwin and Oscoda. Numbers 23-26, red clover sown late in August of 1888, after German millet and Hungarian grass: Mostly failed to catch; in Oscoda this plan worked with great success. Number 24, meadow fescue: Rather thin; two and one-half to three feet high, and pleases all who see it; apparently better than Timothy; manure benefits it; the seeds have fallen and are growing in open places nicely. Number 25, red clover, sown late in August of 1888 after rye; A little rye now seeded; hardly any clover. In Oscoda this plan was a success. Number 27, plowed and left vacant during 1888, sown to red clover this spring and rolled: Came up thick, but was mostly killed by frost later; now very little seen.

The seeding on new land at Harrison this spring all caught first rate and now stands thick on the ground.

HOW TO MANAGE THE LIGHT SANDY LANDS.

Much study and experimenting should be given the subject to learn what are the cheapest and best methods of management. I do not yet pretend to know what is the best course to pursue in all cases.

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In the land itself there is little capital invested, but it is very easy to spend a good deal of work with team and men, which, added to the first cost of land, should, to be profitable, sooner or later all give ample returns for the investment.

I am experimenting on two plans for getting rid of the oak grubs, one by taking them out, root and branch; the other by thoroughly chopping down clear to the grub itself, all the sprouts, late in July or early in August.

I have so far done most of the breaking in spring, but I am inclined to think that a better plan is to plow shallow in July or August, and "back-set" it a little deeper in the following spring for seeding. As a rule, a shrub or tree is most easily killed by disturbing it or injuring it while it is in the midst of a summer's growth. If plowed late in autumn or early in spring, the buds, rootstocks and roots contain much starch stored up ready to push new sprouts on the approach of warm weather.

The land is light and should be rolled. Probably no outlay will pay better than rolling the land in connection with seeding. It presses the particles of soil closer together and brings them closely in contact with the seed. It is one of the peculiarities of these sands, that they do not readily retain moisture; packing the land aids it in retaining moisture.

The ordinary spring-toothed harrow so much used is in my opinion one of the poorest and most unsatisfactory implements that can be used on these sandy lands, especially when new, before the tough roots have decayed. They pull the roots out, disturbing the furrows, requiring considerable labor to get rid of them.

The roots are an advantage to the soil when decayed. If a light slanting-toothed harrow is used the roots will be little disturbed and the surface will be made ready for fine seeds. Give some attention to cutting out the roots of large wild perennials, which the plowing did not kill.

I would not start on this new land with a crop of millet or Hungarian grass. They are exhaustive crops and too easily damaged by frost. Neither would I try potatoes, buckwheat, oats, wheat or corn. If rye is used I should mow it often enough to prevent its seeding, or perhaps plow under when full grown.

So far as I can learn, a mixture of three or more kinds of grasses and clovers occupy the soil more completely and give a better yield than any one kind. The best of these, in my opinion, are mammoth clover, alsike clover, tall oat grass, orchard grass, tall fescue, Agropyrum tenerum (a wild grass from the west), and Timothy; the last perhaps the poorest of all for these sands. From my experience it will take three or four years to secure a good covering of the sands by June grass or meadow foxtail. Red clover is likely to die at the close of the second year, and make it necessary to plow or harrow or in some other way to reseed.

To seed down a new piece of such land, as it is light and the season short, is a slow and rather expensive process. If the seeds of grasses and clovers are started with those of rye, oats or wheat, the catch is likely to be a poor one, and even when sown without another crop, they make only a small growth the first short season. I prefer perennial grasses and clovers to those which are likely to perish in one or two years.

As the process of seeding down is often only partially successful on the first year, if the plants are perennial, we can add more seed here and there and roll the land, thus patching up the thin or vacant spots. Again, the

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perennial grasses and clovers may be allowed to mature seed which will scatter over the ground and help fill up the vacancies. After the land is pretty well covered with a good growth it may be mowed once only, rather early, and not pastured, or if not mowed, pastured only slightly, allowing the plants to keep plenty of leaves for a good growth. After four or six years, the turf may be plowed and a crop of potatoes, oats, peas, buckwheat or wheat taken off, and the land reseeded after the crop is taken off, and remain again seeded for several years.

Aim from the start to keep the land improving by generous treatment. I am inclined to believe that it will be found best in the long run, to add some fertilizer every year, for a time at least, probably superphosphate for clovers and the like, and something else to help the grasses proper, using every speck of barnyard manure than can be found. In the latter case, the subject of carefully husbanding the supply should be well understood, not forgetting that most of the urine of animals is usually lost, although it is of nearly as much value as a fertilizer as are the solid excrements. Some kinds of muck are worth experimenting with.

The poor homesteader, above all others, should understand the principles of agriculture if he expects to succeed on these lands. If he has to depend for his living from the start on what he can dig out of the soil and has no other business to help him, the plains are no place for him.

To manage the sandy plains well and most profitably, if it can be done at all, can best be done by men who have capital, by men who can afford to labor and to wait. If success come at all, it will ultimately come with a generous treatment of the soil from the very start. The land can either be subdued and improved a little piece at a time by the poor man who has a good piece of land to live on, or by the capitalist who may undertake the improvement of large areas.

Finally, do not place too much confidence in some of the suggestions here made, as future and more extended experiments may show that some of them are ill-advised.

W. J. BEAL,
Botanist of the Experiment Station.

AGRICULTURAL COLLEGE, MICH.,
Nov. 1, 1889.

NO. 55—HORTICULTURAL DEPARTMENT.

NOTES ON FRUIT TESTING AT THE SOUTH HAVEN SUB-STATION, BY T. T. LYON.

In response to the earnest requests of the fruit growers along the eastern shore of Lake Michigan, the Board of Agriculture authorized the establishment of a sub-station, for the purpose of testing the value of the new varieties of fruit in that section.

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It was deemed advisable to utilize for that purpose the extensive experimental plantations of T. T. Lyon at South Haven. The necessary arrangements were therefore made with Mr. Lyon, and he has embodied the results of his observations during the past season in the following report.

It has been very carefully prepared, and the author's experience and ability in testing fruits will make it a reliable guide to the fruit growers of Southwest Michigan, and to an almost equal extent to those of the State at large.

L. R. TAFT, *Horticulturist.*

South Haven, Oct., 1889.

To Prof. L. R. Taft, Horticulturist, Experiment Station:

SIR—The arrangements for a branch or sub-experiment station, at this place, not having been effected till last spring, the planting for such purpose has only been commenced since that time, and cannot, therefore, afford useful results during the present season.

Much planting (especially of small fruits) more or less available for such purpose had, however, been previously done; including, also, considerable collections of apples, pears, plums, quinces, cherries, peaches and grapes, as well as a few nuts and other trees, each in considerable variety, selected in very many cases for testing purposes. These had been planted in the spring of 1888, and therefore have not yet shown fruit, and are, for the present, only useful in so far as they afford information respecting vigor, hardiness, habit of growth, etc.

APPLES (*Pyrus malus*).

Forty varieties of the apple have now been planted, of which twelve are of Russian origin, nearly all of which are varieties imported by Professor J. L. Budd, of Iowa.

None of these have suffered from the attacks of fungi, and the only injurious insects have been aphides, which in June appeared in such numbers as to threaten to wholly arrest growth. The spraying of the trees with an infusion of buhach at once arrested their attacks and growth was very soon resumed.

PEARS (*Pyrus communis*).

Thirty-seven varieties of pears have been planted, all on free stocks. Of these, five varieties are from the importations of Prof. Budd, of eastern European varieties.

So far as observed, these have not yet been attacked by either insects or fungi.

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QUINCES (*Cydonia*).

The plantation included five varieties of the quince; none of which have yet fruited.

These were attacked in June by the slug, *selandria cerasi* Peck; but a single application of an infusion of white hellebore in water put a quietus upon their operations for the season.

PEACHES (*Persica vulgaris*).

Of this fruit, thirty-eight varieties are now growing, mostly in their second year. A considerable number of these also are varieties received for trial, while many others are comparatively recent, and, to this region, untested novelties.

Planted in rows with the foregoing are three apricots, one being an importation by Professor Budd from eastern Asia; the others, Russian varieties.

PLUMS (*Prunus*).

Of these there have been planted:

Four varieties of *domestica*.

Six varieties of Prof. Budd's importations, which are also, no doubt, of the *domestica* class.

Seven varieties of native, *Americanas*.

Three *Chicasas*.

Two Japan varieties.

One *Pissard*.

None of these, of course, have yet produced fruit, and none have suffered from insects or fungi, except that a few of the Budd varieties have dropped their leaves, though not to a serious extent.

CHERRIES (*Prunus*).

Of this fruit, twenty-seven varieties have been planted, among which are thirteen of those recently imported from eastern Europe by Prof. Budd. None of these have yet fruited sufficiently to warrant descriptions or comparisons.

GRAPES (*Vitis*).

Of these there have been eighty-seven varieties planted, mostly in 1888, a few of which are showing some fruit, although not enough for experimental

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purposes. They are mostly of *labrusca* parentage, or of hybrids, between *labrusca* and either *vinifera* or *aestivalis*.

Several of them are new, undisseminated seedlings, received from the originators or introducers for testing.

The past summer seems to have been more than usually favorable to the attacks of mildew, and it has attacked the foliage of a few varieties to an extent sufficient to seriously check their growth.

Anthracnose has also manifested itself upon one or more varieties: in the case of five plants of Vergennes, to such extent that they have been taken up and burned to prevent the dissemination of the disease.

NUTS.

Paragon chestnut was received from Pennsylvania and planted in the spring of 1888. It is evidently an early bearer, it having produced catkins freely during both seasons, without, however, showing fruit. Whether it is a native, a seedling of the Spanish, of the more recently imported Japanese, or a cross between two of these, is uncertain. It is claimed to possess the size and early bearing of the foreign and the superior flavor of the native.

Hathaway is a name temporarily applied to a very large and excellent, selected, native variety, grown by B. Hathaway, of Little Prairie Ronde, Michigan, seeds of which were received from him and planted in the spring of 1888. Several of these were transplanted the past spring and are growing finely.

Pecans (*Carya olivæformis*) are usually very difficult to transplant. Yearling plants were received and planted in the spring of 1888, but without success. We, however, received seed from Col. G. B. Brackett, of southeastern Iowa (near the nortern limit of the indigenous growth of this tree), last autumn, which were at once planted, where the trees are designed to remain. These have vegetated freely, and will be left exposed, to determine their ability to withstand the temperature of our lake shore winters.

ENGLISH WALNUT (*Juglans regia*).

Trees of this were received and planted only last spring, and have made a moderate growth. Although this tree has been known to stand here for several years and even to produce fruit, its hardiness must yet be considered doubtful. Trees have therefore been planted as a means of determining the question.

MULBERRIES (*Morus*).

Three varieties of this have been planted.

Russian mulberry (*Morus nigra?*), as received from a western nursery, proves to be of two varieties. Of one the fruit is dark, reddish purple; the other, creamy white. The fruit is freely produced, but quite small and of

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no value. The trees are of spreading, almost drooping, habit, and so far perfectly hardy.

New American (*M. nigra?*) is of upright, spreading habit, producing fruit abundantly, even when quite young. Although the fruit is larger and finer than that of the Russian variety, it appears to be mainly attractive to the birds. It is of medium size and nearly black when fully ripe.

Everbearing, or Downing as it is more commonly called, originated with the late Charles Downing, at Newburgh, N. Y., many years since, from seeds of Multicaulis (*M. alba*). It is scarcely hardy here at the lake shore. The fruit is much larger and finer than either of the foregoing, and ripens in succession for a considerable period, hence the name. In this latitude, in any but the most favorable locations, winter protection will no doubt be found indispensable.

BLACKBERRY (*Rubus villosus*) AND DEWBERRY (*Rubus canadensis*).

Both the plant and the fruit of the blackberry seem to have nearly, if not wholly, escaped the attacks of both insects and fungi during the season.

The injury from the cold of last winter, also, was comparatively slight, only three or four of the most tender varieties, such as Brunton and Dehring, having been perceptibly injured.

Most of the varieties appearing in the following tabulation were planted in the spring of 1888, and are therefore not yet fully in bearing. Still, a few of the notes are from older plants, for which reason another season is requisite to enable us to fully determine their comparative productiveness:

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Number.	Name.	Plant.								
		Place of Origin.	Time of Introduction.	Habit as Indicative of Origin.	Earliest Bloom.	Earliest Ripe Fruit.	Last Picking.	Vigor (Scale 1 to 10.)	Hardiness (1 to 10).	Productiveness (1 to 10).
1	Agawam	.....	.....	u s	June 8	Aug. 1	Aug. 27	5	8-9	5
2	Ancient Briton	.....	.....	u	" 6	" 4	" 30	8	8-9	10
3	Bonanza	.....	.....	u s	.....	.....	.....	5	7	.....
4	Brunton	.....	.....	u	June 16	July 29	Aug. 30	3	2	3
5	Dehring	.....	.....	t	" 9	" 27	" 31	3	2	6
6	Dorchester	N. E.	old	u s	" 9	" 29	Sept. 3	4	3	4
7	Early Cluster	N. J.	1885	u	" 14	Aug. 4	" 1	4	6	5
8	Early Harvest	Ill.	1882	.....	.....	.....	.....	4	.....	.....
9	Erie	Pa.	1886	s	June 11	Aug. 1	Sept. 4	8	9-10	8-10
10	Freed	Mo.	.....	u s	" 11	" 6	Aug. 29	3	5	1
11	Kittatinny	N. J.	1850	u s	" 11	" 1	Sept. 6	8	6	10
12	Knox	.....	.....	u	" 14	" 4	" 5	4	5	4
13	Lawton	N. Y.	1845	s	" 14	" 7	Aug. 29	6	4	9
14	Minnewaski	N. Y.	1886	t s	" 15	" 5	Sept. 5	6	5	9
15	Nevada	.....	.....	u	" 15	.....	Aug. 30	5	3	.....
16	Snyder	.....	.....	u	" 7	Aug. 2	" 30	5	10	9
17	Stayman's Early	Kan.	1882	u s	" 9	July 28	" 26	2	2	2
18	Taylor	.....	.....	s	" 8	Aug. 3	Sept. 3	7	10	10
19	Wallace	.....	.....	s	" 12	" 5	" 3	6	8	7
20	Western Triumph	.....	.....	t u	" 9	" 4	Aug. 29	6	9	10
21	Wilson (Early)	N. J.	1852	u s	" 12	" 1	" 28	6	6	9
22	Wilson, Jr.	N. J.	1884	s	" 8	July 30	" 27	6	6	9
	Dewberry (*Rubus Canadensis*):									
23	Lucretia	Vir.	1884	tr	" 8	" 18	" 15	4	3	8

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The manner of origination of varieties, as well as the dates of their introduction or dissemination, are but rarely explicitly given. These particulars are therefore very generally omitted in the accompanying table:

ABBREVIATIONS USED IN THE TABLE.

Habit of Growth.
s. spreading. tr. trailing.
t. tall. u. upright.

Form of Fruit.
i. irregular. ov. oval or ovate.
o. oblong. r. roundish.

Color.
b. black.

Number.	Fruit.					Remarks.
	Size (1 to 10).	Quality (1 to 10).	Firmness (1 to 10).	Form.	Color.	
1	9	8	4	r o	b	Plants not yet bearing fully.
2	6	6	7	ov	b	Lacks slightly in hardiness.
3	-------	-------	-------	---------	b	Not yet fully in bearing.
4	4	10	5	r o	b	Generally winterkills at Lake Shore.
5	5	10	7	o ov i	b	Generally winterkills at Lake Shore.
6	4	10	10	o	b	Nearly out of cultivation.
7	6	10	5	r o	b	Does not yet show value.
8	-------	-------	-------	---------	b	Planted spring 1889—genuine.
9	10	10	4	r o	b	Very strong spines—almost trailing.
10	3	6	5	r	b	Valueless here.
11	10	10	5	o	b	The heaviest bearer this season.
12	7	7	6	r ov	b	Not yet in full bearing.
13	9	9	5	o ov	b	Sour until thoroughly ripe.
14	10	9	6	r ov	b	Not yet in full bearing.
15	-------	-------	-------	---------	b	But imperfectly tested.
16	6	10	4	r o	b	One of the hardiest.
17	2	8	5	r	b	Has nearly the habit of a dewberry.
18	7	10	4	r o	b	One of the hardiest and best.
19	9	9	4	r o	b	Very desirable for home use.
20	6	9	5	o r	b	Over bears and fruit runs small.
21	10	7	6	r o i	b	Plant needs winter protection.
22	10	7	6	r o i	b	Needs protection in winter.
23	10	8	4	o	b	Its trailing habit protects it.

The following include the more useful and valuable varieties, whether new or old, which appear in the foregoing table, and which have heretofore attracted public notice, or promise sufficient value to warrant future attention:

Early Harvest originated, several years since, in southern Illinois, where it is highly esteemed. It was disseminated by an eastern establishment, which, by some mishap, sent out large quantities of spurious plants under

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this name, which prove to be the Brunton, a very tender variety, and therefore worthless at the north. The genuine Early Harvest is alleged to be hardy, early, productive, and profitable.

Wilson and Wilson, Jr. are so nearly alike that a single notice may suffice for both, the latter being an alleged seedling from the former, by the late Wm. Parry, of New Jersey. Both are exceedingly productive, and the fruits very large, although not of the highest quality. The canes lack hardiness, and at the north must be protected in winter to insure regular crops.

Agawam has been some years before the public, and seems to have not attracted the attention it deserves. It is but slightly deficient in hardiness. Its vigor, size, and productiveness fit it admirably for either the family or the market plantation.

Erie is a new variety coming from Pennsylvania. It so closely resembles the Lawton that some persons consider them identical. A careful comparison during this season shows that the Erie has a decidedly more trailing habit, with the fruit fully as large as Lawton, but more regularly rounded in form. The Erie is also more hardy than Lawton, and has stronger and more troublesome thorns than almost any other variety we know.

Kittatinny made its advent soon after the Lawton, and was disseminated by E. Williams, the present secretary of the New Jersey Horticultural Society. It would probably still stand very near the head of the list were it not lacking in hardiness. Even at the Lake Shore it frequently partially loses its crop from injury during winter. During the present season it has produced a full crop at this place.

Snyder is a strong grower, as well as one of the hardiest of the class. The fruit is of fine flavor, but is decidedly deficient in size.

Taylor is also a vigorous grower, of very spreading habit. It is very productive, and nearly or quite equals Snyder in hardiness. The canes are pale yellowish green. The fruit is considerably larger than Snyder, and somewhat later.

Western Triumph is scarcely as hardy as Taylor or Snyder, although it is rarely injured by our Lake Shore winters. It bears too heavily, so much so that it must have rich soil and good cultivation to maintain the size of the fruit.

Early Cluster is a comparatively recent introduction from New Jersey. So far it has not proved specially early, nor has it shown the productiveness originally claimed for it. It must show decided improvement in this last particular to justify even its continuance upon our list.

Ancient Briton is understood to have come originally from Missouri. It is of medium hardiness and vigor, and very productive. It is superseded.

Minnewaski, originated by the late A. J. Caywood, of Marlboro, New York, can hardly be assumed to have yet established a reputation. So far, it displays valuable qualities as to hardiness, size, and quality. It seems likely to take prominent rank as a market variety.

Wallace, which hails from the west, is hardy and productive, of large size and very good quality. Valuable for both the family plantation and for market.

Lawton is too generally known to need description. Although by some alleged to be identical with the Erie, it ripens later and continues longer in season. It is also a decidedly more upright grower, and is, so far, less hardy.

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CURRANTS (*Ribes rubrum, nigrum* and *aureum*).

Plantings of these were made in the spring of 1888, consisting of:
Eight varieties of reds (*rubrum*).
Two varieties of whites (*rubrum*).
Three black varieties (*nigrum*).

Crandall was also included. This is disseminated as a probable hybrid between the Missouri, yellow flowering (*aureum*), and the cherry currant (*rubrum*), but we are unable to discover in plant, foliage, flower, or fruit anything to warrant such assumption.

The imported currant worm, *Nematus ventricosus* (Klug), attacked the foliage to some extent, but the prompt application of an infusion of white hellebore in water, applied by means of a Woodason sprayer, pretty effectually subdued them, although the appearance of the second brood required a second application.

The currant borer (whether the native or the imported we are not now able to determine) proves to be a very serious enemy to currant culture here at the Lake Shore, since the only known method of subduing them is by cutting away and burning the infected branches, thus destroying more or less of the bearing wood for the following year. Fortunately, there is at least one variety—the Victoria—which, for some reason, is nearly exempt from such attacks.

The premature loss of their foliage during July and August, due, doubtless, to the attacks of fungus, is a malady to which all the red and white varieties are more or less subject, excepting only Victoria and Long Bunched Holland, which seem to be mainly exempt. The commencement of dry, warm weather in July, following the excessive rains of the previous period, seems to have afforded the occasion for such malady.

GOOSEBERRIES (*Ribes*).

The plantations of these, made in the spring of 1888, included the following:

Houghton, which, although claimed to be proof against mildew of the foliage, has, with us, but partially sustained such claim. It has also been subject, here, to a malady (possibly caused by a minute aphis) which effectually checks the growth of the shoots so attacked, and causes the leaves, at or near the tip of each branch, to become crumpled together in a compact mass.

Champion is a quite recent introduction, with long slender shoots like Houghton, though more spreading, and with more and stronger thorns. The fruit is no larger than that of Houghton. It holds its foliage perfectly, and continues its growth till late in the season.

These, we infer, may be referred to *Ribes hirtellum* Michx.

Downing and Smith are usually spoken of as natives. They are more liable to lose their foliage than are the former two; and from their more sturdy habit, their more thorny habit, and greater liability to loss of foliage

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in summer, as well as to the increased size of their fruit, there would seem to be good reason to suspect an admixture of foreign blood.

The plantation also includes the following varieties of foreign origin, viz.: Auburn, Early Orange, Industry, and Dougall's No. 10. We regret to say that, although all except the last have shown more or less perfect fruit, they appear to be alike amenable to the attacks of their potent enemy, mildew, the last especially so.

The currant span-worm attacked the gooseberry also, and yielded readily to the same insecticide.

RASPBERRIES (*Rubus*).

VARIETIES OF IDÆUS AND STRIGOSUS AND SUPPOSED HYBRIDS, INCREASING BY SUCKERS FROM THE ROOTS.

Although usually considered less hardy than the cap varieties, these seem generally to have come through the last winter with little apparent injury, excepting only such tender varieties as Brinckle, Herstine, and possibly a few others, supposed to be mostly or wholly of Idæus parentage.

The spring and early summer here were generally wet and cool, and therefore favorable to the development of fruit, so far as size and quantity are concerned. The weather more recently has been hot and dry. This change seems to have resulted in the development of several forms of fungus. Of these, Anthracnose, or Raspberry Cane Rust, *Glœosporium venetum* Speg., has been more or less common, and has in some cases seriously checked the growth of the new canes.

Quite recently a profuse powdery mildew has, to some extent, attacked the foliage of the Turner raspberry, with the result of checking its development when at scarcely more than half its normal size, although not, apparently, injuring its tissues; the result being, however, to check, if not wholly arrest, the growth of the shoot.

Insects have been but slightly troublesome to the raspberry. Early in the season the girdling and ovipositing of the raspberry cane borer, *Oberea bimaculata* Oliv., was occasionally observed; but this can scarcely be considered an injury, since the attacks were very rare, while the result usually was the shortening of the cane, followed by branching, and a consequently increased amount of bearing wood for the ensuing year's crop. The subsequent operations of the larvæ may be readily prevented by the prompt removal and destruction of the girdled portion of the cane, including the egg deposited therein. The wilting and drooping of the tips of the injured canes render their detection an easy matter.

The following embrace the most desirable or promising of those included in the tabulated list, arranged, as nearly as practicable, in the order in which they ripen:

Hansell is usually the earliest variety to ripen. Although the fruits are neither large nor of high quality, nor yet is the plant vigorous, still it is worthy of being planted, on a limited scale, on account of its extreme earliness.

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Marlboro, originated by the late A. J. Caywood, of Marlboro, N. Y., has been put forward as a market variety. Although moderately vigorous and hardy, its productiveness and consequent value for this purpose can hardly be said to be yet fully established.

Turner has been too long and too generally known to require description. On strong, rich soil, and especially where superior hardiness is requisite, it may fairly be accorded the leading position among varieties of its class.

Reder originated in Southwestern Michigan. The plant is somewhat lacking in vigor, and produces comparatively few suckers, but in size and quality the fruit has very few, if any, superiors, or even equals, among the red varieties.

Brinckle (Brinckle's Orange) is a pure Idæus seedling, originated in a Philadelphia city garden, many years since, by the once noted amateur horticulturist whose name it bears. It is a prince among raspberries, so far as both quality and beauty are concerned, but, sad to say, it is also one of the most tender, and must have protection even in ordinary winters.

Superb is a New Jersey seedling, which was brought to notice at the same time with Hansell. It ripens very nearly with Hansell. The berry is much larger, often fully seven-eighths of an inch in diameter. It is high-flavored, like most of the *strigosus* class, to which it belongs; and the pips or grains are so loosely put together that it is difficult to pick the berries without crumbling. The color, also, is quite too dark to suit the popular taste.

Cuthbert is a native of Riverdale, New York. Although not entirely hardy, it is one of the hardiest of its class; which fact, together with its healthy, persistent foliage, its vigor and productiveness, and the pleasant flavor and superior handling quality of its fruit, have won for it a high position both as a family and a market fruit.

Golden Queen possesses all the desirable qualities of the Cuthbert, both of plant and fruit, which is bright yellow when ripe. It is said to have been discovered in a plat of Cuthbert plants, and is supposed to be a sport from that variety.

Herstine takes its name from its originator, a Mr. Herstine, of Pennsylvania. It lacks hardiness, and is also slightly deficient in productiveness; while in size, brightness of color, and also in quality, it can hardly be said to have a superior.

Caroline was originated at New Rochelle, N. Y. It is supposed to be a hybrid between Brinckle and a Golden Cap, and possesses several peculiarities apparently sustaining this assumption. It may be propagated by both suckers and "tips." It is extremely hardy, and enormously productive, too much so for the size and quality of the fruit, except under high cultivation. The texture of the fruit is quite too delicate to warrant its use for market purposes.

Brandywine is an old variety of unknown origin, which possesses valuable qualities for the market in both the east and the west. It has the unusual peculiarity that it can be left upon the plant, when fully ripe, for a considerable time without suffering essential injury.

The following list of varieties will afford a satisfactory supply for a family, while the surplus, if any, may be marketed if desirable:

First, Turner; second, Herstine; third, Golden Queen; fourth, Cuthbert.

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If extra trouble in the way of winter protection can be afforded, the quality may be improved by the addition of the Brinckle.

RASPBERRIES, RED AND ORANGE,

Number.	Name.	Plant.									
		Class.	Place of Origin.	Time.	Earliest Bloom.	First Ripe Fruit.	Last Picking.	Vigor (Scale 1 to 10).	Hardiness (1 to 10)	Productiveness (1 to 10).	Fungi.
1	Brandywine	S	.....	old	June 16	July 18	Aug. 9	7	8	8	....
2	Brinckle	I	Pa.	1845	" 12	" 9	" 1	5	1	10	....
3	Caroline	H	N. Y.	.....	" 11	" 12	" 5	8	10	10	....
4	Crimson Beauty	S	.....	.....	" 11	" 10	" 3	7	7	7	A S
5	Cuthbert	S	N. J.	1870	" 10	" 10	" 12	10	10	9	A S
6	Eastern King	S	.....	.....	" 10	" 10	" 7	6	8	5	....
7	Golden Queen	S	N. J.	1883	" 9	" 8	" 9	10	10	9	....
8	Hansell	S	N. J.	1877	" 5	" 5	" 5	4	10	5	....
9	Herstine	S I	Pa.	.....	" 16	" 12	" 3	6	4	6	A
10	Marlboro	S	.....	.....	" 10	" 7	" 7	7	9	8	....
11	Meredith	S	.....	.....	" 11	" 20	" 12	6	8	4	....
12	Michigan Early	S	.....	.....	" 10	" 7	" 7	6	9	7	....
13	Philadelphia	S	Pa.	.....	" 13	" 12	" 9	7	10	7	....
14	Rancocas	S	.....	.....	" 8	" 8	" 1	6	9	.....	....
15	Reder	S	Mich.	1880	" 10	" 8	" 8	5	5	7	A
16	Reliance	S	N. J.	.....	" 11	" 10	" 7	6	10	10	A S
17	Scarlet Gem	S	.....	.....	" 8	" 7	" 9	6	8	5	....
18	Superb	S	N. J.	.....	" 8	" 9	" 9	3	8	8	A
19	Surprise	S	.....	.....	" 15	" 12	" 7	8	6	8	....
20	Turner	S	Ill.	.....	" 10	" 8	" 5	9	10	5	D

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ABBREVIATIONS USED IN THE TABLE.

Class.	Form.	Color.	Fungi.
I. Idaeus.	c. conical.	r. red. b. bright.	A. Anthracnose.
S. Strigosus.	i. irregular.	p. purple. d. dark.	D. Downy mildew.
H. probable hybrid.	r. roundish.	o. orange. du. dull.	S. slight.
		l. light. g. glossy.	

WHICH PROPAGATE BY SUCKERS.

Number.	Fruit.					Remarks.
	Size (Scale 1 to 10).	Quality (1 to 10).	Firmness (1 to 10).	Form.	Color.	
1	6	6	9	r	d r	Suckers very freely.
2	7	10	9	r c	o	Very tender. Requires protection.
3	8	8	4	r	l o	Increases by both suckers and tips.
4	9	6	6	r	d r	Berries often imperfect.
5	10	7-8	10	r c	r	Leading red market variety.
6	7	4	4	r	du r	Promises little value.
7	10	7-8	10	r c	o	Possibly a sport from Cuthbert.
8	5	5	7	r	d r	Chiefly valued for its earliness.
9	9-10	9-10	6	r	b r	Superior save as to hardiness.
10	9	6	7	r	du r	Originated by the late A. J. Caywood.
11	6		6	r	l o r	A beautiful fruit.
12	6	4	7	r c	r	First noticed in New Jersey.
13	4	4	5	r	d p r	Old. Nearly superseded.
14	8	------	------	r	r	Needs further trial.
15	8	9	8	r	r	Quality of fruit superior.
16	8	5	9	r	d r	A seedling of Philadelphia.
17	6	4	5	r	b r	Requires further trial.
18	10	7	5	r i	d g p	Crumbles badly in picking.
19	8	6	5	r c	d r	Crumbles badly in picking.
20	5-7	8-9	4	r c	r	Very hardy. Canes thornless.

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RASPBERRIES,

VARIETIES OF OCCIDENTALIS AND SUPPOSED

ABBREVIATIONS.

Class.
O. Occidentalis.
H. supposed hybrid.

Fungi.
A. Anthracnose (*Glœosporium venetum*, Speg.)
D. Downy mildew of the foliage.

Number.	Name.	Plant.									
		Class.	Place of Origin.	When introduced.	Earliest Bloom.	First Ripe Fruit.	Last Picking.	Vigor (Scale 1 to 10).	Hardiness (1 to 10).	Productiveness (1 to 10).	Fungi.
1	Ada	O	Ohio	1889	----	----	----	4	10	----	----
2	Beebe	O	N. Y.	1886	June 6	July 9	Aug. 3	7	10	9	A
3	Butler	O	Conn.	1887	" 7	" 11	July 31	8	10	5	A
4	Carman	O	Conn.	1887	" 7	" 11	" 29	4	10	5	----
5	Centennial	O	----	----	" 7	" 8	" 31	7	10	8	A
6	Doolittle	O	----	----	" 7	" 8	" 31	6	10	8	A
7	Domore	O	----	1889	----	----	----	4	---	----	----
8	Earhart	O	Ill.	1887	June 8	July 10	July 31	10	10	8	----
9	Florence	O	N. J.	1881	" 8	" 17	Aug. 5	6	8	8	A
10	Gregg	O	Ind.	1880	" 12	" 18	" 5	10	7	9	A
11	Hilborn	O	Ont.	1886	" 10	" 12	" 3	5	10	4	----
12	Hopkins	O	----	----	" 10	" 10	July 31	7	10	7	A
13	Indiana	O	Ind.	1884	" 10	" 12	" 31	8	10	5	A
14	Johnston's Sweet	O	N. Y.	1886	" 10	" 10	Aug. 7	6	10	9	A
15	Kellogg	O	Wis.	----	" 6	" 12	" 2	8	10	6	----
16	Mammoth Cluster	O	----	----	" 12	" 13	" 5	9	10	8	A
17	Nemaha	O	Neb.	1883	" 14	" 18	" 5	10	10	10	----
18	New Rochelle	H?	N. Y.	----	" 9	" 10	" 1	7	10	7	----
19	Ohio	O	N. Y.	----	" 6	" 11	" 5	7	10	10	A
20	Palmer	O	Ohio	1888	----	----	----	8	----	----	----
21	Shaffer	H?	N. Y.	1880	June 10	July 10	Aug. 7	10	10	10	A
22	Souhegan	O	N. E.	----	" 5	" 8	July 31	7	10	8	----
23	Springfield	O	Ind.	----	" 5	" 7	" 29	5	10	6	----
24	Tyler	O	----	----	" 5	" 8	" 31	7	10	8	----

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BLACK AND ORANGE.

HYBRIDS ROOTING FROM THE TIPS OF THE CANES.

ABBREVIATIONS.

Form.
c. conical.
i. irregular.
o. oblate.
r. round.

Color.
p. purple. b. black.
pu. pubescent. d. dark.
s. slightly. g. glossy.
v. very. o. orange.

Number.	Fruit.					Remarks.
	Size (1 to 10).	Quality (1 to 10).	Firmness (1 to 10).	Form.	Color.	
1	-------	-------	-------	-------	-------	Planted spring 1889.
2	4	5	8	r	o	Dirty looking brown when overripe.
3	5	6-7	7	r	g b	Received for trial from Mr. Butler, Conn.
4	5	5	8	r	b	Trial not satisfactory.
5	5	7	5	r	g b	Not comparatively valuable.
6	7	7	6	r	g b	The oldest, among the best early.
7	-------	-------	-------	-------	-------	Received for trial, planted spring 1889.
8	4-6	6	9	r	g b pu	Fall, ripening in September on new canes.
9	6	5	7	r	o	Color dirty brown when over ripe.
10	10	4	10	o	b pu	Lacks juice and quality, market.
11	6	6	8	r	b	Is probably not the genuine.
12	7	6	7	r	b pu	Profitable, generally satisfactory.
13	6-7	6	9	r	b	Received from E. Y. Teas of Indiana.
14	5	7	9	r	g b	Mild in flavor for a blackcap.
15	5	6	8	r	b pu	Is not relatively valuable.
16	7	8	7	r	b v pu	Still a good market blackcap.
17	10	7	9	r	b pu	Much like Gregg, but hardier and better.
18	8	8	5	r c	d pu	Has the hardiness and habit of a blackcap.
19	6	6	8	r	b	Very seedy, valued for drying.
20	-------	-------	-------	-------	-------	Planted spring 1889.
21	10	9	7	r i	p pu	Highly valued, especially for canning.
22	5	8	8	r	b	Valued for its earliness.
23	4	8	9	r	b	Practically identical with Davison.
24	5	8	8	r	b	Same practically as Souhegan.

The following, which embrace the more valuable of the tabulated varieties, are mentioned, as nearly as practicable, in the order of their ripening:

Souhegan and Tyler, although doubtless of separate origin, are practically identical, so far as the characteristics of both plant and fruit are concerned. They are more especially valuable as the first of their class to

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ripen, although, in fact, but two or three days in advance of the older Doolittle.

Beebe (Beebe's Golden) is really golden only when taken just at the right stage; when only a few hours past this, the color changes to a forbidding, dirty looking brown, which is a serious drawback upon its value even for the family garden.

Doolittle was the first variety of its class to attract public attention; and even yet the improvement upon it consists more in variation of the season of ripening than in any important improvement of other qualities.

Ohio is especially commended as being superior for evaporating purposes. Its superiority in this respect is believed to consist mainly, if not wholly, in the fact that the seeds are large, and for that reason constitute an unusual proportion of the desiccated residuum.

Earhart is a very vigorous variety, which produces a moderate crop of fruit upon the last year's canes at the usual season, and a second crop in September upon many of the new canes of the current year. This second crop is quite liable to be ruined by frost before full maturity. It will be mainly valued by the curious, and by those desirous of having this fruit out of its regular season.

Hopkins is understood to have originated in Missouri. Although not extensively known in Michigan, it proves successful and profitable here also.

Johnston's Sweet was brought out by Robert Johnston, of New York. It is a very productive black cap, of exceedingly mild flavor, and is, like the Ohio, valued for evaporating purposes, doubtless for the same reason.

Shaffer (Shaffer's Colossal) is, as its synonym imports, a very vigorous grower, even for one of its class. It is frequently spoken of as a hybrid, the chief evidence of which is the unusual color of the fruit, which, when fully ripe, is a very dark brown, and very pubescent. The fruit is very large; and its high, sprightly flavor renders it very popular for canning among persons who have learned its peculiarities.

Hilborn is a comparatively recent variety, originating in Ontario. That described in the tabulation is strongly suspected to be spurious. The genuine Hilborn is of large size, nearly as large as the Gregg, and of superior quality.

Gregg occupies the leading position as a market variety on account of its large size, productiveness, and good handling qualities. It cannot be rated very high so far as flavor alone is concerned.

Mammoth Cluster (McCormick) was the leading market blackcap till displaced by the Gregg. It appears to be rapidly going out of use.

Nemaha is a comparatively recent introduction from Nebraska. It has most, if not all, the valuable qualities of the Gregg, with improved flavor and superior hardiness. It seems likely to supersede that old favorite, even as a market variety.

As a desirable selection for a family plat we would name Souhegan (or Tyler), Hilborn, and Nemaha, with Shaffer for canning.

The foregoing will suffice also for a market plantation, with the possible substitution of Gregg in place of Hilborn.

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STRAWBERRIES (*Fragaria*).

The plat from which the following notes are made was planted in the spring of 1888, and having supplied plants for the sales of last spring, some varieties had been dug very closely, leaving in some cases little beyond the old plants; while others had been left comparatively full—all being in matted rows. A comparison as to productiveness, by measuring the yield of each, was therefore impracticable. Such comparative yield has therefore been estimated, using for the purpose a scale ranging from one to ten. The same scale is also used to express the comparative vigor of varieties, hardiness of the plant, under the influences of the past year, together with the size, quality and firmness of texture of the fruit.

During the past season a new plat has been planted with reference to the repetition of these observations under more satisfactory conditions. This new plantation is especially arranged for convenience in referring to and comparing varieties, and the rows have been kept evenly filled, and the plants replaced where vacancies have occurred. Many of the newer or recently introduced varieties have also been included.

In the following descriptions, the letter B following the name of a variety indicates that it is bi-sexual or perfect flowering; P, that it is pistillate, or practically without pollen producing organs. B P is attached to a few varieties whose blossoms show so few anthers that their sufficiency for perfect fertilization may be considered doubtful. B P is also attached to certain varieties in which there is a still greater deficiency of anthers, and which, to insure complete fertilization, should be planted near a pollen supplying variety.

In the following tabulation the descriptions are extended across two opposite pages, and numbers are used to avoid difficulty in tracing the connection.

The form and color of the fruit are given by use of the following abbreviations:

Form.	Color.
b. Broad or compressed.	b. Bright.
c. Conical.	c. Crimson.
d. Depressed or oblate.	d. Dark.
i. Irregular.	l. Light.
l. Long.	r. Red.
o. Oval or ovate.	s. Scarlet.
r. Roundish.	

The extent to which the plant is attacked by fungi is indicated as follows:

a. Clear.
b. Slightly spotted by *Sphærella fragariæ*, Sacc.
c. Much spotted " "
d. Very badly spotted " "
e. General discoloration, perhaps from over-maturity.

The dates of origination are in most cases to be considered as merely approximate, many of them having been inferred from the dates of introduction, or from mere recollection of our first acquaintance with the variety.

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STRAWBERRIES.

ABBREVIATIONS FOR THIS TABLE.

Fungi (Sphœrella fragariæ Sacc.).
a. clear.
b. slightly spotted.
c. much spotted.
d. very badly spotted.
e. general discoloration, perhaps from over maturity.

Form.
c. conical.
l. long.

Number.	Name.	Plant.									
		Sexuality.	Place of Origin.	Time.	Earliest Bloom.	First Ripe Fruit.	Last Picking.	Vigor (Scale 1 to 10).	Hardiness (1 to 10).	Productiveness (1 to 10).	Fungi.
1	Acme	P B	Conn.	1884	May 11	June 18	July 6	2	2	2	b
2	Alpha	B	Ont.	1881	" 8	" 12	" 4	6	9	8	b
3	Anna Forest	B	N. J.	.....	" 11	" 24	" 8	7	7	7	d
4	Arnold's Pride	B	Ont.	1881	" 10	" 19	" 8	9	10	9	b
5	Belmont	B	Mass.	1880	" 13	" 24	" 8	9	10	8	b
6	Bidwell	B	Mich.	1872	" 7	" 17	" 6	9	10	9-10	a
7	Black Defiance	B	N. J.	.....	" 7	" 18	" 6	9	7	6	b
8	Bomba	B	N. J.	1880	" 8	" 15	" 12	10	10	7-8	b
9	Boone (Daniel)	P	Ky.	1878	" 9	" 21	" 8	6	8	5	b
10	Boyden's 30	B	N. J.	1870	" 9	" 20	" 8	7	9	6	c
11	Bright Ida	B	Ont.	1881	" 9	" 19	" 10	9	10	9	c
12	Bubach No. 5	P	Ill.	1885	" 11	" 18	" 8	10	10	10	a
13	Burt	B	N. Y.	1887	" 13	" 18	" 10	6	10	4-5	c
14	Captain Jack	B	Mo.	1874	" 10	" 24	" 8	8	10	7	e
15	Champion	P	Pa.	1872	" 10	" 20	" 8	5	7	8	b
16	Charles Downing	B	Ky.	1860	" 9	" 23	" 8	9	10	8	b
17	Cheny (Col.)	P	N. Y.	1872	" 9	" 18	" 8	4	3	8	a
18	Clara	B	Ohio	1888	.....	.....	.....	.....	.....	.....	a
19	Cloud	P	La.	1887	May 11	June 20	July 8	9	9	5	b
20	Cohanzick	B	N. J.	1884	" 9	" 17	" 8	4	8	5	a
21	Cornella	B	Ohio	1882	" 9	" 22	" 10	8	7	6	a
22	Covill	B	N. J.	1886	" 8	" 13	" 6	10	10	8	d
23	Crawford	B	Ohio	1887	.....	.....	.....	.....	.....	.....	b
24	Crescent	P	Conn.	1870	May 7	June 15	July 10	9	10	10	a
25	Crimson Cluster	P	N. J.	1882	" 12	" 19	" 6	6	4	5	a
26	Cumberland	B	Pa.	1874	" 9	" 18	" 8	9	9	8	d e
27	Dew	B	Mich.	1876	" 18	.....	.....	10	10	.....	a
28	Dewey	B	Conn.	1883	" 8	June 19	July 6	8	2	8	b
29	Duncan	B	.....	.....	" 7	" 19	" 8	8	8	4	d
30	Dutter	B	.....	.....	.....	.....	.....	.....	.....	.....	a
31	Earle	B	Tex.	1886	May 15	June 21	July 4	7	8	4	a
32	Early Canada	P	Ont.	1880	" 9	" 17	" 6	6	8	4	b
33	Emerald	B	Eur.	.....	" 7	" 18	" 6	4	6	5	b
34	Eureka	P	Ohio	1884	" 15	" 20	" 8	7	8	7	a
35	Fairy	P	.....	.....	" 7	" 19	" 8	4	10	8	c
36	Galceron	B	Ga.	1883	" 14	" 22	" 10	10	9	6	b

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STRAWBERRIES.—CONTINUED.

ABBREVIATIONS—*Continued.*

Form—*Continued.*
b. broad or compressed. i. irregular. r. roundish.
d. depressed or oblate. o. oval or ovate.

Color.
b. bright. l. light. r. red.
c. crimson. d. dark. s. scarlet.

Number.	Fruit.					Remarks.
	Size (Scale 1 to 10).	Quality (1 to 10).	Firmness (1 to 10).	Form.	Color.	
1	6	7	5 to 7	r o	b c	Not yet disseminated. Not worthy.
2	4	8	4 5	o c	l r	Most prolific. Very early variety.
3	7	7	3 4	c	b s	Of little apparent value.
4	8	8	7 8	i c	l r	Excellent. Too pale for market.
5	9	10	6 8	l o	b s	A valuable variety for the home.
6	8-9	9	6 9	l c	b c	Better when grown in hills.
7	8-9	8	9 10	r b	d c	Very old; and generally superseded.
8	9-10	8	4 5	c	c	A seedling from Crimson Cluster.
9	6	5	5 6	r o	d r	Lacks productiveness; and too acid.
0	7	7	6 7	r c	d c	Still a good amateur variety.
11	8	8	7 8	r b c	l r	Too dull in color for market.
12	9-10	6	6	r b d c	b c	Highly prized as a market variety.
13	6	7	9	r d c	d r	May prove to be Captain Jack.
14	4	6	9	r c	b c	Fruit stems taller than foliage.
15	6	5	8 9	r c	d c	Still occasionally planted for market.
16	6	7	5 7	r c	d s	Still much planted for market.
17	6	8	5 6	r b c	b c	Now nearly superseded.
18	.....	9	8 10	r	b c	A trial variety, not disseminated.
19	6	8	9 10	r	d r	Plants set late last fall.
20	4-5	6	7 8	r	d r	So far shows little value.
21	8	9	8 9	r c	d s	Plant very deficient in vigor.
22	3-7	9	9	r	d c	Sets more berries than it matures.
23	.....	.....	.....	.....	.....	Planted late this spring.
24	7	6	6	r c	b c	Sometimes nearly self-fertilizing.
25	5-6	9	6	d c	d c	Superior flavor. Very unproductive.
26	9	7	6	d r c	l c	Always perfect in form and even sized.
27	10	6	9 10	b r c	d c	Planted last spring. Fruit enormous.
28	5	7	5	r	c	Not disseminated. Unworthy.
29	8	9	7	c	d r	A very old variety. No longer planted.
30	.....	.....	.....	r c	d r	Planted late last spring.
31	5	8	4	o	b c	A trial variety from Texas.
32	4	7	6 7	r b c	d c	A good early amateur variety.
33	5	5	4	b c	d c	Like most foreigners, not valuable.
34	8	7	7 8	r c b	d c	New, promising for market.
35	4	5	3	r	l c	Plant lacks vigor.
36	5	9	9	r c b	d r	Popular in northern Georgia.

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STRAWBERRIES.—CONTINUED.

ABBREVIATIONS.

Fungi (Sphœrella fragariæ Sacc.).
a. clear. c. much spotted. e. general discoloration, perhaps from over-maturity.
b. slightly spotted. d. very badly spotted.

Form.
c. conical.
l. long.

Number.	Name.	Plant.									
		Sexuality.	Place of Origin.	Time.	Earliest Bloom.	First Ripe Fruit.	Last Picking.	Vigor (Scale 1 to 10).	Hardiness (1 to 10).	Productiveness (1 to 10).	Fungi.
37	Gandy	B	N. J.	1885	May 16	June 19	July 12	10	10	9	c
38	Garibaldi	B	N. Y.	.....	" 10	" 25	" 6	7	2	3	a
39	Garrettson	P	.....	.....	" 10	" 19	" 8	5	3	4	b
40	Gipsy	P	.....	.....	" 7	" 17	" 8	5	10	3	d
41	Glendale	B	Ohio	1871	" 12	" 24	" 12	8	9	3-4	b
42	Gold	P	Conn.	1884	" 15	" 19	" 8	5	7	8	b
43	Goldsmith	B	Ohio	1877	" 10	" 18	" 8	9	8	5	b
44	Hampden	P	Mass.	1884	.....	.....	.....	...	...	.....	b
45	Hathaway No. 8	P B	Mich.	1876	May 16	June 25	July 10	10	9	6	a
46	Hathaway No. 5	P	Mich.	1876	" 12	" 22	" 8	9	8	7	a
47	Hathaway No. 9	P	Mich.	1876	" 9	" 21	" 6	10	5	6	b
48	Haverland	P	Ohio	1884	" 8	" 14	" 10	5	10	10	a
49	Henderson	B	N. J.	1880	" 13	" 19	" 8	6	3	3	a
50	Hoffman	B	Md.	1885	" 10	" 17	" 6	5	4	3	a
51	Indiana	B	Ind.	1875	" 10	" 23	" 8	10	5	5	c
52	Itasca	P	Ind.	1886	" 10	" 23	" 8	9	10	6	a
53	Jersey Queen	P	N. J.	.....	" 16	" 19	" 8	7	7	5	b
54	Jessie	B	Wis.	1885	" 10	" 17	" 10	10	10	9	a
55	Jewell	P	Conn.	1882	" 10	" 18	" 16	5	6	8	b
56	Jucunda	B	Belg.	1855	" 15	" 26	" 10	7	10	5	d
57	Kentucky	B	Ky.	old	" 12	" 26	" 10	10	10	7	e
58	Lady Rusk	P	Ohio	1887	.....	.....	.....	...	...	.....	a
59	Lida	P	N. J.	1883	May 9	June 18	July 8	6	10	10	b
60	Little No. 10	B	Ont.	1887	.....	.....	.....	...	...	.....	b
61	Logan	B	Ind.	1886	May 10	June 19	July 10	10	10	9	b
62	Longfellow	B	Ky.	1876	" 11	" 19	" 8	9	9	5	c
63	Loudon's No. 15	B	Wis.	1887	.....	.....	.....	...	...	.....	b
64	Louise	B	.....	.....	.....	.....	.....	...	...	.....	a
65	Maggie	B	Ont.	1881	May 8	June 18	July 8	6	7	10	c
66	Mammoth	B	N. J.	1886	" 14	" 19	" 12	10	10	7	b
67	Manchester	P	N. J.	1876	" 11	" 22	" 10	9	6	8	e
68	Martha	P B	Minn.	1886	" 11	" 20	" 8	10	10	6	b
69	May King	B	.....	.....	" 12	" 17	" 8	10	9	8	b
70	Miami	P B	Ohio	1878	" 12	" 20	.....	....	....	.....	a
71	Miner	B	N. J.	.....	" 7	" 20	July 8	9	10	8	b
72	Monmouth	B	N. J.	1885	" 16	" 25	.....	3	3	4	c

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STRAWBERRIES.—CONTINUED.

ABBREVIATIONS.—*Continued.*

Form.—*Continued.*
b. broad or compressed. i. irregular. r. roundish.
d. depressed or oblate. o. oval or ovate.

Color.
b. bright. l. light. r. red.
c. crimson d. dark. s. scarlet.

Number.	Fruit.					Remarks.
	Size (Scale 1 to 10).	Quality (1 to 10.)	Firmness (1 to 10).	Form.	Color.	
37	9	9	8	r c b	d c	Profitable. Late.
38	7	7	5	l c	r	Utterly unprofitable.
39	5	5	6	r c	c	Not valuable here.
40	5	6	4	r c	l r	Not valuable here.
41	8	7	7	l c	d c	Like Kentucky, lacks productiveness.
42	7	9	7	r	d c	A good family berry.
43	10	9	8	o c	b c	First berries large. Soon became small.
44	.....	.....	.....	o	b r	Planted late in spring of 1889.
45	8	6	6	l c	b r	For trial. Not disseminated.
46	9	9	7	l c	c	For trial. Not disseminated.
47	6	6	7	r c	s	For trial. Not disseminated.
48	8	7-8	6	l c	s	Perfect in form, even sized, profitable.
49	6	10	8	o c	c	Superior flavor its chief recommendation.
50	4	8	8	r	d r	Valued in Maryland.
51	5	6	6	c	l c	Not productive enough for profit.
52	7	7	6	r	c	Later berries fail to develop.
53	8	8	7	r b	l r	Has generally proved unproductive.
54	10	6	7	r c b	d c	Very promising for market.
55	10	6	7	r c i	b c	Produces very few plants.
56	8	5	9	r c	b s	Needs hill culture and strong soil.
57	7	6	7	l c	b s	Late market.
58	.....	.....	.....	.....	.....	Planted spring 1889.
59	7	7	4	r c	b c	Sets too much fruit. Late berries poor.
60	.....	.....	.....	.....	.....	Planted late in spring of 1889.
61	7	7	5	r d c	b c	Has good qualities for market.
62	9	6	6	l c	c	First fruits large. Late ones imperfect.
63	.....	.....	.....	.....	.....	Planted late in spring of 1889.
64	9	9	8	o c	b c	Planted spring of 1889. Promising.
65	6	8	5	r o i	l s	Too dull colored to be attractive.
66	10	7	5	l c r b	b c	First fruits very large.
67	8	8	9	r d c	c	Exhausts itself by overbearing.
68	4	7	7	r d c	d r	Plant satisfactory. Needs farther trial.
69	4	7	5	r b c	l c	Can scarcely be called profitable.
70	.....	.....	.....	.....	.....	Planted in spring of 1889.
71	7	6	5	c	d c	Becomes cockscombed on strong soils.
72	8	7	7	c	d r	A failure here.

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STRAWBERRIES.—Continued.

ABBREVIATIONS.

Fungi (Sphærella fragariæ Sacc.).
a. clear.
b. slightly spotted.
c. much spotted.
d. very badly spotted.
e. general discoloration, perhaps from over-maturity.

Form.
c. conical.
l. long.

Number.	Name.	Plant.									
		Sexuality.	Place of Origin.	Time.	Earliest Bloom.	First Ripe Fruit.	Last Picking.	Vigor (Scale 1 to 10).	Hardiness (1 to 10).	Productiveness (1 to 10.)	Fungi.
73	Moore's Prolific	B	Mich.	1884	May 13	June 20	July 9	10	10	9	a
74	Mrs. Cleveland	P	Ohio	1887	" 7	" 12		9			a
75	Mount Vernon	B			" 12	" 23	July 12	10	10	9	b
76	New Dominion	B	Ont.	1875	" 8	" 18	" 8	7	8	5	c
77	Nicanor	B	N. Y.	1850	" 7	" 12	" 5	7	9	7	c
78	Norman	B			" 7	" 18					b
79	Ohio Centennial	P	Ohio	1888	" 9			9			c
80	Ohio	P	Ohio		" 15	June 27	July 12	5	10	8	d
81	Ontario	B	N. Y.	1885	" 11	" 22	" 8	9	7	7	a
82	Parker Earle	B	Tex.	1886	" 6	" 14		9–10	10	10?	a
83	Parry	B	N. J.	1880	" 8	" 19	July 8	7	6	8	b
84	Pearl	B	N. J.	1884	" 11	" 19	" 8	10	10	9	b
85	Phelps, *Old Ironclad*	B			" 8	" 18	" 6	9	9	7	c
86	Pineapple	B	Md.?								
87	Piper	B	Ill.	1876	May 11	June 19	July 6	8	7		
88	President	B			" 12	" 20	" 10	6	6		
89	Prince (of Berries)	B	N. J.	1880	" 15	" 22	" 8	8	4		
90	Richmond	B	Mich.	1883	" 10	" 26	" 10	10	9		
91	Seneca Queen	B	N. J.		" 11	" 26	" 6	7	9		
92	Sharpless	B	Pa.	1874	" 12	" 25	" 8	9	7		
93	Shirts	B	Mich.	1875	" 11	" 18	" 6	10	10		
94	Sucker State	B	Ill.						1		
95	Summit	P	Ohio	1880	May 15	June 22	July 12	5	6		
96	Sunapee	B	N. J.	1884	" 9	" 18	" 6	7	10		
97	Surprise (Truitt)	B			" 9	" 21	" 10	8	8		
98	Townsend No. 8	P	Ohio	1888							
99	Townsend No. 19	P	Ohio	1888							
100	Triomphe de Gand	B	Belg.		May 10	June 24	July 8	4	4		
101	Unnamed (Little)	B	Ont.	1884	" 9	" 23	" 10	8	8		
102	Vick (James)	B	Mo.	1882	" 12	" 21	" 8	7	10		
103	Warfield No. 2	P	Ill.	1883	" 8	" 17	" 10	8	10		
104	Warren	B	Ky.		" 11	" 18	" 6	4	4		
105	Wilson	B	N. Y.	1860	" 7	" 18	" 9	9	10		
106	Windsor	P	Mich.	1875	" 11	" 20	" 8	5	9		
107	Wonderful	B			" 9	" 18					
108	Woodruff No. 1	B	Mich.	1872	" 10	" 18	July 10	4	4		

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STRAWBERRIES.—CONTINUED.

ABBREVIATIONS.—*Continued.*

Form.—*Continued.*
b. broad or compressed. i. irregular. r. roundish.
d. depressed or oblate. o. oval or ovate.

Color.
b. bright. l. light. r. red.
c. crimson. d. dark. s. scarlet.

Number.	Fruit.					Remarks.
	Size (Scale 1 to 10.)	Quality (1 to 10).	Firmness (1 to 10).	Form.	Color.	
73	10	6	7	o b c	l r	Much like Jessie in plant.
74	.....	.....	.....	.....	.....	Received spring, 1889, for trial.
75	7	8	7	r c	b s	Late, valuable.
76	5	6	7	d c	b r	Nearly superseded.
77	4	9	4	r o c	r	An old seedling by Ellwanger and Barry.
78	.....	.....	.....	.....	.....	Planted in spring of 1889.
79	.....	.....	.....	.....	c	Received for trial spring of 1889.
80	6	4	5	r c	b c	Late, valuable for this, if at all.
81	9	8	6	b c	d s	Much like Sharpless. Very vigorous.
82	5-6	9-10	4	l c	b c	Planted late last fall. Stood perfectly.
83	9	9	8	r c	l c	Slightly lacking in vigor.
84	7	8	10	l c	c	A promising semi-southern variety.
85	5	7	6	r c	s	Prized for market by some planters.
86	.....	.....	.....	.....	.....	Suspected to be an old variety, renamed.
87	5	5	6	r c	b c	For market lacks productiveness.
88	4	7	6	r c	b c	Lacks productiveness.
89	7	10	9	r	l r	Persistently unproductive.
90	7	7	7	c i	b c	Fruits often imperfect.
91	7	8	6	r d	b r	An excellent family variety.
92	9	8	6	b c	b c	Better when grown in hills.
93	5	8	7	l c	d c	Not sufficiently productive.
94	.....	.....	.....	.....	.....	Utterly failed this year.
95	9	7	8	r c	d s	A fine amateur berry.
96	4	6	5	r c	d r	Of very little value.
97	.....	.....	.....	.....	.....	Of very little value.
98	.....	.....	.....	.....	.....	Received for trial spring 1889.
99	.....	.....	.....	.....	.....	Received for trial spring 1889.
100	7	9	9	r c	b r	Need strong land and hill culture.
101	7	7	7	l c	c	Received from Ontario without name.
102	5	9	10	r	d c	Rather small for the market.
103	5	7	4	r c	b c	Promising as a market variety.
104	5	8	6	r	d c	An amateur variety.
105	6	8	10	c	d s	Later pickings run small.
106	6	6	8 to 9	r c	d c	Apparently identical with Champion.
107	.....	.....	.....	.....	.....	Planted spring 1889.
108	8	6	8	l c	d c	Not productive enough for market.

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No insect attacks have proved seriously injurious to strawberries during the present season, save that a few varieties were planted last spring in a small plat infested by cut-worms, which were persistently dug up and finally eradicated.

A very few leaf-rollers were observed, but they were too rare to require special attention.

Of fungi, the only one deserving special notice is *Sphærella fragariæ* (Sacc.), the development of which occurred too late in the season to seriously injure the fruit; although the young plants may, and doubtless will be, more or less injured thereby. The extent to which this disease is noticeable upon the old plants is indicated in the foregoing table in the column headed Fungi.

The following brief notices are added, of some of the older varieties thought worthy, and already attracting more or less attention, together with a few new varieties, which seem likely soon to do so.

Alpha is the result of a cross by the late Charles Arnold of Paris, Ontario, between a foreign variety—Dr. Nicaise—and the Wilson. It is very mild in flavor, and has so far proved the largest and most productive of the numerous very early varieties which we have heretofore tested. Bisexual.

Arnold's Pride comes from the same cross, as well as from the same batch of seed as the foregoing. Its tendency is to set too much fruit to be properly matured on any but rich soils. For the market it lacks brightness of color. Bisexual.

Belmont originated in Massachusetts. The fruit is of large size and of superior quality. It requires rich, deep soil, and high cultivation to insure satisfactory results. A superior family berry if well grown. Bisexual.

Bidwell is one of B. Hathaway's numerous originations, and is well worthy of hill culture, by means of which its tendency to excessive production of plants is suppressed and its energies directed to the production of fruit. Bisexual.

Bomba—a New Jersey seedling—is one of the very large berries. In ordinary cases in matted rows only the first specimens will be large. It should always be grown in rich, deeply prepared soil, and preferably, in hills to insure satisfactory results. Bisexual.

Bright Ida is also a result of the cross of Dr. Nicaise and Wilson by Charles Arnold, and comes also from the same batch of seed with Alpha and Arnold's Pride, all which have a family resemblance in both plant and fruit. It would doubtless be desirable as a market berry but for its dull color. Bisexual.

Bubach No. 5 has now been several years in the hands of general planters. It has acquired a high position as a market variety, although pistillate and somewhat deficient in both quality and firmness. It is one of the most valuable of the large varieties.

Burt, a supposed accidental seedling, recently discovered in northern New York, has so strong a resemblance to Captain Jack that it is strongly suspected to be merely a re-introduction of that variety, to which it surely has too strong a resemblance to justify the addition of a new name to the list. Bisexual.

Champion, an old variety from eastern New York, is an alleged progenitor of the Windsor, more recently brought to notice in Michigan. The two are to all appearance identical, and the variety is now almost universally known

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and spoken of by the latter name. It is still to some extent planted for market. Pistillate.

Charles Downing, one of our oldest varieties, a Kentucky origination by the late J. S. Downer, still holds a somewhat prominent position as both a market and family fruit. It is too well and generally known to need a description. Bisexual.

Clara is a new variety, received for trial late in the fall of 1888. We are favorably impressed by its performances so far. The plant is vigorous and healthy. It requires farther trial to properly show its value as a producer of fruit. Bisexual.

Cloud is also a new variety discovered in Louisiana, and already very popular there. It has been widely tested at the north during the past season. Another season's trial is needed with us, as doubtless elsewhere. to determine its status in regions so widely removed from its original locality. Pistillate.

Covill is a comparatively new early variety. Last year it proved unproductive and too small. This year it set an enormous crop, and the earlier berries were large and excellent; but later ones were small and imperfect, and still later ones were nearly or quite abortive. Bisexual.

Crawford, first disseminated this year, is one of the somewhat numerous originations of Matthew Crawford of Ohio, who deems it his most valuable production. Plants set late last spring show a vigorous habit, but have not yet produced fruit with us. Bisexual.

Crescent is too well and generally known to need description. With persons who grow strawberries for market, in matted rows, it is yet a prime favorite in spite of its pistillate character. Among the better class of cultivators it is less popular. Nearly pistillate.

Cumberland is generally known and valued for its large and always perfectly formed fruit, which only needs a little more firmness of texture and brighter color with increased productiveness to entitle it to stand in the front rank of both family and market fruits. Bisexual.

Eureka is the name of a variety rejected several years since. It is now applied to a new variety originated in Ohio. From a two or three years' trial, we regard it as valuable for market. Pistillate.

Gandy is a comparatively recent introduction which gives evidence of decided value as a late variety for general purposes. Bisexual.

Glendale, an accidental seedling from Ohio, stands next to Kentucky among the older varieties as a late market fruit. Bisexual.

Haverland is one of the very recent varieties which is attracting much attention. It has shown itself at least fully as productive as Crescent, of larger size and better flavor. The plant, also, is healthy and vigorous. It is pistillate.

Indiana, named for its native state, was sent out several years since as a market variety. Several years' trial shows that its position is a debatable one in this respect. Bisexual.

Itasca, recently introduced from Indiana, is, apparently, not likely to win a standing among profitable varieties; although possessing some desirable qualities both of plant and fruit. Pistillate.

Jessie has been extensively advertised and rapidly and widely disseminated. With the mass of growers its vigor of plant and the size of the fruit will doubtless render it permanently popular; while those who place quality

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first will need to look farther for it. The size of its later specimens can only be maintained on good soils by high culture. Bisexual.

Kentucky, originated many years since by the late J. S. Downer, of that State, can scarcely, even yet, be said to have a rival as a late market strawberry; although it decidedly lacks productiveness. Bisexual.

Lida was disseminated a few years since by the late Wm. Parry, of New Jersey. It sets an enormous crop of fruit, which it can only mature with rich, deep soil and good cultivation. Even with these it may be doubtful if it will fully perform its early promise. It is pistillate.

Logan comes from the same source as Itasca, to which a two years' trial shows it to be superior. The plant is very vigorous, and it promises well as a market variety. It is bisexual.

Louise is a very recent introduction, which is highly commended by those who have tested it. Our plants were only set last spring, and have borne too little to warrant an opinion respecting it. Bisexual.

Maggie is one of four crossbred seedlings by the late Charles Arnold, of Ontario. Like the others, it is a vigorous grower, an enormous bearer, mild in flavor, and lacking in color; and hence not adapted to market planting. A valuable family berry. Bisexual.

Mammoth was disseminated by the late Wm. Parry, of New Jersey, and his successors. The fruit is very large and the plant a vigorous grower, but the size of the later specimens diminishes rapidly unless well sustained by good soil, manuring and cultivation. Bisexual.

Manchester is still somewhat popular as a rather late and very productive variety. Its chief fault seems to be, that the plant becomes so exhausted by the maturing of the first season's crop, that the plantation needs to be renewed after the production of a single crop.

May King shows few, if any, kingly characteristics here. It does not fruit heavily, as compared with others of its season. It is commended in some quarters as a good fertilizer to plant among pistillates. It is strongly bisexual.

Miner (*Miner's Great Prolific*) is a New York or New Jersey seedling originated many years since, which has long stood very near the head of the market list of popular varieties. On light soils it is very satisfactory; on heavy or very rich soils the fruits are inclined to be badly misshapen. Bisexual.

Moore's Prolific (prolific is surplusage) is reported to have originated recently in Wayne county, Michigan. We planted it only last spring. It proves to be a vigorous grower. During the fruiting season we examined a row of this growing beside one of Jessie, of the same age. There was little, if any, difference in vigor or productiveness, nor yet in the size of the fruit, although there was a manifest difference of form; and we thought the Moore somewhat superior in flavor. Bisexual.

Mount Vernon is a variety disseminated many years since. On heavy soils especially it is eminently valuable as a late market fruit; while at the same time its quality will justify planting it in the family plat. Bisexual.

Ontario is very much like Sharpless, so much so that little would be lost by dropping one of them. The difficulty would be to decide which should be retained.

Parker Earle is a very recent new variety, originated in Northern Texas. Plants received and planted late last autumn came safely through last

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winter, with a slight mulch for protection; and although seriously injured the past spring by cut-worms, the plants have shown remarkable vigor, and give promise also of abundant productiveness. Another year's trial is necessary to fully determine the measure of its success. Bisexual.

Parry, after several years' trial, must be assigned the position of a superior family or amateur variety. The plant is only moderately vigorous, yet produces medium crops of large, fine looking fruit, of excellent quality. Bisexual.

Pearl is a comparatively recent variety, coming, if we mistake not, from Maryland. Here it has, during a two years' trial, developed good characteristics as a market variety, while its comparatively high quality renders it satisfactory for the family plat. The plant is abundantly vigorous as well as productive. Bisexual.

Seneca Queen, as we understand, is one of the Miner seedlings; originating, as the name implies, in New York. It is one of the most beautiful of strawberries; but its characteristics fit it more especially for the home plantation, in which, with proper care, it will be found very satisfactory. Bisexual.

Sharpless originated in Pennsylvania. It occupies a somewhat questionable position, as a market variety. Its fine size is highly satisfactory for this purpose; and with high cultivation, and especially in hills, it is fairly productive; but, with ordinary management, in matted rows, it lacks productiveness. In quality, it is one of the best of the large varieties. Bisexual.

Summit is one of M. Crawford's originations. The plant is somewhat deficient in vigor, as well as in productiveness. The fruit is very large, and, like the Cumberland, is always very perfect in form, even when overgrown. It is best adapted to the family plantation. Pistillate.

Vick (James) is, in both plant and fruit, so nearly like Captain Jack that one description would suffice for both, save that the Vick is slightly inferior in size. Bisexual.

Warfield No. 2 is a recent variety from Illinois, and bears the name of its originator. It is greatly to be regretted that this, as well as several others, has been permitted to go to the public with numbers attached to the names, since this greatly increases the liability to errors of nomenclature. Great productiveness and vigor are the special claims of its originator. A single season's growth and fruitage but partially sustains such claim. Pistillate.

Wilson may almost be said to have been the fundamental means of developing the now extensive interest of commercial strawberry culture. Its quality, when fully ripened, may fairly be termed excellent; but its popularity, as a market variety, grows more especially out of the circumstance that it colors very early, and may be gathered and put upon the market while yet firm enough to bear rough handling. More recently it is very commonly attacked by that troublesome enemy of the strawberry plant, the fungus—*Sphærella fragariæ*—for which reason, together with the rivalry of more modern varieties, it is, to some extent at least, giving place to others. Bisexual.

Windsor is alleged to be of Michigan origin, and to have sprung from seed of a cross of Chas. Downing upon Champion, but the almost universal verdict of experts has been that the Windsor and Champion are identical. Although we have kept the two distinct, and have observed them carefully for years, we have been compelled to accept the above verdict. It is generally

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called for under this name, rather than Champion, but both appear to be going out of use. Pistillate.

Woodruff No. 1 originated fifteen or twenty years since at Ann Arbor, Mich. Although the berry is considerably elongated, unlike many others of that form, it ripens at the tip as early as elsewhere. It was at one time a popular variety at Ann Arbor, but has never been extensively planted elsewhere. It is likely soon to be wholly superseded. Bisexual.

For a family or farm garden, to be grown in matted rows, mere quantity being of less importance than quality, a good selection of five varieties from the foregoing lists would be Alpha or Covill for early, followed by May King, with Belmont and Parry for medium and late, and Mount Vernon to close the season.

If to be grown in hills for the use of the family, Alpha, Bidwell, Belmont, Sharpless, and either Mount Vernon or Kentucky would give a good succession.

For market, in matted rows, a profitable succession would be Crescent or Haverland with Miner as a fertilizer, Bubach No. 5 with Logan to fertilize it; closing the season with Mount Vernon, or perhaps Kentucky.

For market, to be grown in hills, a good succession would be Covill, Cumberland, Jessie, Sharpless, Mount Vernon and perhaps Kentucky.

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FARMERS' INSTITUTES.

HELD DURING 1889, UNDER THE AUTHORITY OF THE STATE BOARD OF AGRICULTURE.

Flint, Genesee Co.—January 29, 30 and 31, attended by Professors R. C. Carpenter, E. A. A. Grange and Dr. Manly Miles.

Grayling, Crawford Co.—January 31 and February 1, attended by Hon. O. Palmer and Hon. A. C. Glidden, of the Board of Agriculture, and by Professors R. C. Kedzie, W. J. Beal, L. R. Taft and F. S. Kedzie.

Big Rapids, Mecosta Co.—February 7 and 8, attended by Professors E. J. MacEwan, A. J. Cook, W. J. Beal, R. C. Carpenter and Mr. H. Campbell.

Lake Odessa, Ionia Co.—February 11 and 12, attended by Professors S. Johnson, L. R. Taft, E. A. A. Grange, H. R. Pattengill, and Messrs. H. T. French and L. A. Breggar,

Brooklyn, Jackson Co.—February 14 and 15, attended by Professors R. C. Carpenter, S. Johnson, E. A. A. Grange, H. R. Pattengill and Mr. Chas. S. Crandall.

Centreville, St. Joseph Co.—February 18 and 19, attended by Professors A. J. Cook. W. J. Beal, E. J. MacEwan, W. F. Durand, W. L. Simpson and Mr. James Wiseman.

Albion, Calhoun Co.—February 20 and 21, attended by Professors E. A. A. Grange, W. F. Durand, W. L. Simpson and Mr. Eugene Davenport.

President Edwin Willits and Secretary H. G. Reynolds attended each of the institutes.

In this report of the institutes will be found the material part of such of the papers presented as have come into the hands of the secretary. Those of a specially local character are placed with the program of which they formed a part, in order of sequence immediately following.

All other papers have been grouped according to subject and can be most easily found by reference to the index at the back of the volume.

FLINT INSTITUTE.

PROGRAM.

TUESDAY, JANUARY 29, 2 P. M.

Prayer.
Music.
Address of Welcome.....Mayor Stone.
Response for the State Board of Agriculture.....Col. Wm. B. McCreery.
President's Address.....Hon. S. R. Billings.
Paper—The External Conformation of the Horse.....Dr. E. A. A. Grange.
Paper—The Farmer's Son, his Home, the Farm and Nation...Rev. W. L. Farnum.
Discussion.....Rev. J. E. Jacklin.
Paper—Pure Bred Herefords for Beef.....J. W. Foster.
Music.

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Evening Session, 7 P. M.

Music.
Paper—Fruit Culture.....Hon. N. A. Beecher.
Discussion.....C. T. Rosenkrans.
Question Box.
Paper—The Farmer's Home.....Mrs. Monteville Benjamin.
Paper—The Short Horn for the Average Farmer.....Hon. William Ball.
Discussion.....Geo. W. Stuart.

WEDNESDAY, JANUARY 30, 9:30 A. M.

Paper—Making and Repairing Roads.....Prof. R. C. Carpenter.
Paper—Country Roads.....A. L. Aldrich.
Discussion.....J. K. Perry.

Afternoon Session, 2 P. M.

Paper—Breeding.....Dr. Manly Miles.
Paper—Professional Men as Farmers.....Hon. Sumner Howard.
Discussion.....Dr. R. N. Murray.

Evening Session, 7 P. M.

Music.
Address—The Farmer, His Cousins and Friends.....President Willits.
General Discussion.
Paper—Breeding and Feeding of Fat Cattle.....Dr. J. C. Willson.
Discussion.....M. R. Freeman.
Paper.....Ira T. Sayre.

THURSDAY, JANUARY 31, 9:30 A. M.

Paper—Swine, Their Care and Management.....J. W. Hibbard.
Discussion.....S. C. Goodyear.
Paper—Farm Gardening and Small Fruits.....J. L. Wilcox.
Discussion.....Opened by B. Turner.

Afternoon Session, 2 P. M.

Paper—Sheep, Their Care and Management.....Geo. W. Stuart.
Discussion.....C. H. Rockwood.
Paper—The Relation of Farmers to Railroads.....Hon. Jno. T. Rich.
Discussion.....H. C. Spencer.
Paper—The Care and Feeding of Dairy Cows.....Philo Begole.

Mayor Stone on behalf of the city briefly and cordially welcomed the members of the institute and the representatives from the College, and in the absence of Col. Wm. B. McCreery, Judge George R. Gold responded for him on behalf of the Board of Agriculture.

The substance of his remarks is as follows:

RESPONSE TO WELCOME, BY JUDGE GEORGE R. GOLD.

MR. PRESIDENT—It is very unexpected to me, and disappointing to you to stand in the place of our scarred and battered fellow citizen, Col. McCreery, who, while it is possible he may sometimes hesitate when there is something to be *said*, he was never known to falter when there was anything that should be *done*.

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I am asked to respond for the Board of Agriculture of the State of Michigan.

Many people can often speak the most intelligently concerning the things they least understand, which may account for my being here. I am not a farmer—beyond a few years' experience, when as a barefooted boy I stubbed my chapped toes over a rough New England farm, where, according to the rhyme of one of her ancient poets:

> "The Almighty from His boundless store,
> Piled rocks on rocks—but did no more."

* * * did not a thing more, except to sprinkle a little loam into the crevices * * * (you see He had but little soil left for that land of ice and granite, after He had supplied the bouhdless west). I know but little about farming. I know little of agriculture, either as a practice or a science. I know almost as little of it as my professional brother who buys that expensive plaything, called a farm, and then turns the income from his profession upon it, and finally succeeds in coaxing a spindling crop from the reluctant sod.

But when we turn to the statute, where the lawyer sometimes looks for his information, we learn that the State Board of Agriculture shall consist of six members besides the Governor of the State and the President of the Agricultural College. And I am happy to inform you that his excellency, the Governor is well, and is doing excellently well. And the worthy President of this College is also in good health, and will be here and edify you before you shall adjourn. But while I cannot talk intelligently upen farming, I can, in common with the ordinary citizen of Michigan, say a word in just praise of this institution, from which for the last thirty years there has flowed a stream of valuable information that has benefited the State, the nation and the world, and it has also raised and sent forth a crop of well equipped young men that adorn every calling, profession and station in life.

I have lately seen a catalogue of the names of men who have gone out from that institution from which I shall take the liberty of quoting a few facts.

Of the 42 Experiment Stations for the advancement of Agricultural Science established last year by act of Congress in the various States of this Union, seven, or one-sixth of the whole number, are presided over by men from this Michigan Agricultural College.

The Agricultural Colleges of three other States have for their Presidents men from the Michigan Agricultural College, and in nineteen States they have obtained men for their faculties from among the graduates of the Michigan Agricultural College.

Such a record for an institution not yet 32 years old is one of which any college in the world may well be proud. I know of no better harvest than such a crop of graduates, unless indeed it be a crop of fair and intelligent daughters, fit to accompany them.

I am sure the members of the State Board of Agriculture are glad to enjoy the hospitality of the dwellers in our pleasant city, and I know that our citizens are most happy to have this Board with us.

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PRESIDENT'S ADDRESS, BY HON. S. R. BILLINGS.

LADIES' AND GENTLEMEN—Perhaps it would not be out of place for me to ask our city cousins for a sketch of the bright and joyous side of farm life, such as painted by the artist and sung by the poet. We see the picture and hear the music.

A beautiful landscape, a comely house and barn, windmill near pumping water for the cattle feeding on the sloping hill. Shade trees, here and there, and fruit trees all around. Fields of waving grain. Meadows of sweet scented clover. Labor saving machines are carrying whistling drivers, drawn by blooded horses. Yes, we see the pets of the pen, pasture and stall, lambs capering like children at play, and colts testing their speed, as if for the coming races.

And there is the well dressed farmer with his wife and children seated in a fine carriage behind his prancing bays.

With this picture before us, who would not be a farmer, a farmer's boy or a farmer's girl. Who would not sing of merry harvest time.

> Had I a dozen active boys to guide in life's career,
> I'd have them all be farmers true, as sure as I am here.
> Had I a dozen pretty girls, as fair as summer's morn,
> I'd marry them all to farmers' boys, as sure as I am born.

We will draw the curtain on this picture, and look over on the other side, where the majority of the farmers live, where there is less poetry and more hard work, and not such a longing to have the boys and girls stick to the farm.

We see an average farm of eighty acres, it looks passing well as a landscape picture, but there is a shadow over the fields, house and barn, and that shadow is a mortgage, part of the purchase price. The occupants are laboring with heroic zeal to keep the "wolf from the door," to pay taxes, pay interest and raise the mortgage, and the while, clothe and educate their children in keeping with the age in which they live.

Take away the picture of the artist and song of the poet, and look at the warfare waged by these earnest workers for bread and home. No baby's hand or kid glove labor will avail them. They must fight if they would win. Enemies are on every hand, seen and unseen, in the earth and on the earth.

The worm family which no man can number, challenges them to mortal combat, and disputes their right to the products of earth. They put in an early claim to the growing grain. They lay seige to the root, to the stalk, to the blossom and the kernel. They capture the currants and the cabbage. They destroy the plums, the cherries and the apples. Slugs are in the roses and bugs on the grapes and potatoes. As old enemies are vanquished new ones take their places, with new methods of destruction.

The farmer must have skill to fight these ravaging hordes or they will take his bread and leave him without a place he can call his own. But we have said enough to show that farmers must have knowledge if they would succeed. The time has gone by when, according to the old saying, "anybody can be a farmer." Mere thoughtless work, expenditure of mere muscular energy, uninspired and unvitalized by thought, study, mental discipline,

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will never help the farmer to win the race in these days of sharp competition. Thought should sit enthroned as the regnant deity in the shrine of the farm, and should put its spirit into the dynamics of muscle and machinery alike. Farming is a science. All its processes, from turning up the soil with a plow to the conversion of its products into money, are scientific. The farm is a laboratory wherein the operator must use the principles of chemistry, botany, meteorology, and political economy, and a farmer who does not have a practical knowledge of these things will get left. The principle of the "survival of the fittest" is nowhere better illustrated than on the farm. It is the farmer who uses most brain power who "gets there" on the farm, as in the mercantile or professional world. But we have said enough to show that farmers must have knowledge—knowledge of their business, if they would succeed. And may this institute be the means of aiding many a farmer to a higher and happier condition, and hasten the day of his moving over on the sunny side of farm life, master of his business, everything in order, good buildings, *out of debt* and with money at interest. Then, and not till then, can he sing: "Come, be a farmer, and with the farmers stand."

GRAYLING INSTITUTE.

PROGRAM.

THURSDAY, JANUARY 31, 7 P. M.

Music.....Glee Club.
Prayer.....Rev. J. W. Taylor.
Address of Welcome.....A. J. Rose, Pres. Crawford Co. Ag'l. Society.
Response.....Hon. E. Willits, Pres. Agricultural College.
Life at the Agricultural College. Illustrations and views by the Stereopticon. Description by Prof. L. C. Colburn.
Appointment of Committees.

FRIDAY, FEBRUARY 1, 9:30 A. M.

Corn and Wheat on the Plains.....Henry T. Shafer.
Gardens.....J. Steckert.
Seeds.....Prof. L. R. Taft.
Fire Extinguishers, with Illustrations.....Prof. F. S. Kedzie.

FRIDAY 1:30 P. M.

Fruits.....Henry Funch.
Forestry.....Prof. W. J. Beal.
Discussion.

FRIDAY 7 P. M.

Music.....Glee Club.
Woman's Work on the Farm.....Mrs. May Barker.
Results on the Experimental Farm.....Dr. R. C. Kedzie.
Discussion.
Reports of Committees.

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PRESIDENT A. J. ROSE,

In his address of welcome, referred to the slighting terms often used of farmers, such as "Pig feeders," "Hay seeds," "Buckwheats," "Mossbacks," and "Flat feet," terms which show a very unthinking failure to appreciate the importance of the calling by which alone it is possible for any other calling to exist. "The farmer feeds them all"—whether the millionaire or the tramp, the sailor, the mechanic or the so-called "professional men,"—all depend upon the receipient of these ill considered attempts at wit. This being his real position, then, it is easy to see the importance of his receiving whatever aid science can extend.

In responding to the welcome, President Edwin Willits expressed the opinion that the time was not far distant when this "jack pine region" would be the chief dairy district of the State, saying that he deemed the introduction of dairy farming to be the true solution of the problem of the plains.

CORN AND WHEAT ON THE PLAINS.

BY HENRY T. SHAFER.

CORN.

I began farming in Center Plains Township in the year 1881. I broke up a small piece of land and planted it to Large Dutton corn, which I brought with me; the result was a good growth of stalks, but no corn.

Since then I have grown as follows:

Year.	Variety.	Acres.	Crop per Acre—Bushels of ears.	Remarks.
1882	Small Canada	3	25	New breaking.
1882	" "	3	25	Second plowing.
1883		5		Killed by frost before maturing.
1884		3	50	Second plowing. Good season.
1885			35	
1886			50	
1887			60	On clover sod. All sound.
1888			65	Three-fourths of crop good sound corn.

I have tried several different kinds of corn, and have learned to my satisfaction that the Canada corn is the only kind adapted to this climate. The best time to plant is about the 20th of May; I prepare the ground well before planting, and plant about 3½ feet each way, and commence working at it as soon as I can see to follow the rows, and keep the ground well stirred up until about the 4th of July. I have used some fertilizers but do not think it pays. Clover sod turned under makes the best yield of corn.

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WHEAT.

In 1881 on first plowing I seeded a small piece of ground to clover, with poor result; the next year, 1882, I summer fallowed the same piece and sowed it to wheat the last days of August, sowing 1½ bushels of seed and 100 pound of salt per acre, yield 15 bushels of wheat per acre. The next year, 1883, on 8 acres of first plowing, plowed the first days of July, and wheat sowed the last days of August (that always being my time of seeding), and not sowing more than one and one-half bushels of wheat per acre, it yielded me 90 bushels. The year 1884, on five acres of first plowing and two acres of second plowing, yield 97½ bushels of good clean wheat. Year 1885, on eight acres of first plowing, plowed the last days of June, yield 65 bushels wheat. The next year, 1886, I summer fallowed eight acres and put barn-yard manure on the thinnest spots, and plowed eight acres of wheat stubble, making 16 acres, yield 157 bushels of wheat (being badly winter-killed); the next year, 1887, plowing under clover the last of June and sowing to Seal wheat, yield 22½ bushels per acre; the same year on corn ground, following clover, yield 21 bushels of Clawson wheat per acre. I have now eight acres of wheat on the ground, looking fine when it went under the snow. I plow new ground about four and one-half inches deep, second plowing five inches; clover sod 6 inches deep. I cultivate and thoroughly prepare my ground before sowing. I think the more this land is worked the better crops we raise, and that clover and plaster is as good a fertilizer as we need. Plaster to make the growth and clover to plow under to enrich the soil. I am not discouraged with these plains, I think they can be made A No. 1 farms.

DISCUSSION.

Dr. Beal: At what time of year would you plow new land?

Mr. Shafer: The last of June and the first of July. If you plow earlier in the season the wild morning glory will come up afterwards and be a perfect pest.

Use a sharp share and plow only four and one-half inches deep and you will not be troubled with sprouts. It kills and rots all there was growing. Besides that it leaves a good mould near the surface in which you can sow clover and have it grow; whereas, if you plow seven inches deep clover will not catch, as it has only clean dirt to—die in.

I sow clover by preference the third year from breaking, in August, with wheat, or early in spring, May, sowing alone, on cultivated ground, and drag it in. I have no trouble with it catching, no more than in Lapeer county, where I came from. It does not winter-kill though wheat sometimes does.

Mr. Metcalf: I have farmed fifty years in Michigan, thirty years in Tuscola county, on first class land, and have no more trouble with clover here than there. The winter that killed Mr. Shafer's wheat, killed some for me, but left my clover so that it gave me one ton per acre.

Mr. Silsby: There is great difference in soils here, and mine is of the worst.

I have best success with clover by seeding in June. If earlier, a very small insect destroys it. These insects are so small as to be barely visible.

I never raised more than eight bushels, per acre, of wheat, on my place;

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nor could I raise corn. I tried five years on eighty acres, with a team and sixteen head of cattle, and had to give it up. I could raise rye but my stock and pocketbook found it too poor pickling. Timothy did better than clover.

Mr. Rose: As to this insect. I sowed clover in May like oats and only looked at it on Sundays, and between two Sundays, on a strip four to six feet wide, next to wild land, the clover was so much gone that I made up my mind I had skipped it in seeding. The same day, with a magnifier, I saw little black insects that hopped like a flea and seemed to have no wings, but to be hard shelled, and that ate off the clover. I mixed five pounds Paris green with plaster, and sowed it and stopped the mischief right then.

Mr. Wayne, of Roscommon: I have sowed clover successfully in spring and in fall. Clover has been worthless this year. It grew up four inches and turned yellow. I supposed it was the drought but examining some found the yellow stalks hollow at the top for an inch or two. Last year I had 22 acres of clover, and only got only two and one-half tons. Part I did not try to cut at all.

Once on four acres I got 16 loads first cutting, and four loads the fall cutting. I use June clover.

I sowed Orchard grass, Rye grass, Tall Oat grass and clover mixed, and it looks well. The Rye grass killed out, but the rest did well.

Last September 17 I sowed three bushels per acre of Orchard grass, and it looks well.

Question: What is Mr. Shafer's land?

Mr. Shafer: Five or six acres go one and one-half feet deep to a hard pan that goes three or four feet to light sand. On other spots, perhaps not half a rod distant from the above, I can strike the spade down its full length and strike no obstacle. I see no difference in yield between the two spots.

A neighbor has a piece that had been cropped four years and failed to grow corn, and this summer, on that, by cultivating, he got a good clover catch.

I think rolling does less good than cultivating. I don't think it pays.

The morning glory roots fill our soil, and if not killed out by cultivating it will kill out any crop.

Mr. Jacob Steckert: I had 40 acres in clover and timothy two years ago. I sow in the fall and have no trouble. In the spring I am liable to loss from drought. I have cut from one to two tons per acre. I sow one-third timothy and two-thirds clover; one peck per acre. My land is somewhat stony. I think very well of rolling land.

My son had a light, sandy piece, and I sowed five acres of barley and five acres of oats and 150 pounds of phosphate, and got 20 bushels per acre of oats and 15 bushels of barley. Phosphate costs $34 per ton, by car load, and I think it pays to use it. My land is improving in quality. I bought only one car load of phosphate and sold part of that, but I use a good deal of barn-yard manure, 700 loads brought from Roscommon stables for 95 acres. Even without manure, with good culture, the land gradually becomes firmer and better.

President Willits: Can you better your land without stable or commercial fertilizers?

Mr. Steckert: Yes, by green manuring. The commercial fertilizer is used up the first year in a wet season, but not in a dry season.

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GARDENS, BY JACOB STECKERT.

I have no paper, but will give from memory a report of two and one-half acres, somewhat stony land, on the south side of a hill.

The first year, in addition to what we needed for family use, this two and one-half acres netted us $200 cash, and the second year $400. I raised chiefly lettuce, radishes, melons and squashes. A strip of lettuce 12 feet wide by 100 feet long netted me $21, and a strip of radishes the same size $28. A patch of nutmeg and water melons 30 feet by 100 feet netted me $100. Of course I got fancy prices, because the demand exceeded the supply. In seven years I have only twice succeeded in getting good melons. Tomatoes are caught by early frosts before they ripen, usually, though three years, by trimming the vines, I have succeeded in ripening them.

Mr. Glidden: Did you manure your garden and use the same spot continuously?

Mr. Steckert: Yes, for five years till it got so foul with weeds that I had to put it to wheat and clover for two years to clean it and now I have it in garden again. I have rotated crops from one part of the garden patch to another.

Mr. Pelt: Frost last year and year before came in August, last year on the 28th.

I have no complaint as to our soil, but the climate I can not provide against. My corn was spoiled and so were my cucumbers and my potatoes, but some pie pumpkins which I think much better than Hubbard squash ripened. How to force my garden out of the way of the first frosts I don't know. I plant corn May 20 in my garden and radishes, cabbages and peas as early as I can after snow.

A good rain once a week would save us.

Prof. Taft: My plan would be in the fall to plow in manure and in the earliest spring to plant hardy things and put on a little phosphate in the hill to hurry starting, and in the summer a little ground bone to hurry fruiting and ripening, and through the period of growth to keep the ground stirred on top one inch, not lower.

Sometimes a box covered with mosquito net holds heat and hurries growth.

Tomatoes can be started in the house very early and transplanted several times before final setting out.

Mr. Niles: I start tomatoes in hot beds and use old unsoldered tin cans, tarred paper or birch bark tied together for flower pots and set them in the hot bed, if I have it, or in a warm window or near the stove on a board till time to set out; then I prepare the hill with two or three shovels full of manure and set the can in and so don't check the growth in transplanting, and set four feet apart and mulch with manure to prevent drying out, and when the fruit is setting I nip out all superfluous growth and let it ripen down on the ground, when, by trimming, it is fully exposed to the sun and kept warmer than when lifted up on trellises.

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FRUITS, BY MR. HENRY FUNCH.

Grayling, Feb. 1, 1889.

MR. CHAIRMAN, LADIES AND GENTLEMEN—I have been requested to appear before you today to give you my experience in fruit raising.

I settled in South Branch township in the spring of 1874, and planted my first fruit tree in 1877, fourteen apple trees, eight pear trees and two grape vines, as an experiment. Out of the lot I lost but three trees, two Red Astrachan apple trees and one Bartlett pear tree; the roots of the pear tree were badly scraped when I got it, so I knew that it was not the climate that killed it. I have added to my orchard from year to year, and have now about one hundred and seventy-five trees, some of which I have raised from the seed.

I picked twenty-two bushels of apples from thirteen trees last fall, the varieties were Golden Russet, Maiden's Blush, Transcendent and Seek no Further, some of the trees are not what I ordered, so I cannot tell you the names of all of them. Of pears I have the Bartlett, Anjou, Flemish Beauty and Clapp's Favorite; the Bartlett does remarkably well; of pears I had about two bushels. I shall plant no more dwarf pear trees, I consider the standards better in every way. I have two Concord grape vines trained up on the south side of my house that bear well every year, and by layering I have secured several more vines which I planted at a little distance from the house, and they are all doing well. Three of them bore fruit last summer.

I raised some peach trees from the pit which grew finely and bore fruit twice; they were fine, large peaches but rather late for this climate; they have not borne fruit for some years now; the fruit buds freeze during the winter.

Of cherries I have the little red sour.

I believe that our soil here is not in a right condition to plant trees until after the third plowing.

I set my trees about thirty feet apart, and dig the holes about two and a half feet across and twenty or twenty-two inches deep; I throw the sub-soil to one side, then I take some leaf mould, which I get from a swamp, and mix it well with the top soil, then I fill the hole with that until it is the right depth for the tree. I set them as deep as they were in the nursery, then I fill in about the roots, shaking it in well so as to have the ground firm and solid around every little root. I put the sub-soil on top as much as I need of it, and then mulch. In planting trees I do not trim the tops much unless they are too heavy, for sometimes they start late and do not have a chance to ripen the new wood, then if injured by frost they will have a chance to fall back on the last year's growth; I give them a light dressing of wood ashes occasionally. I plant my orchard to corn or potatoes; sometimes the trunks of the trees turn black, but a good scrubbing with soap suds makes them bright and clean again. My farm is on a hill, the soil is a little heavier than on the plains, the timber is white and red oak, pine, poplar and soft maple.

Mr. Funch exhibited specimens of Ben Davis, Pomme Gris and Seedling apples.

Dr. Kedzie: A potash soap made from ashes would be better for washing trees than soda soap.

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Mr. Funch: I think a leaf mould mulch from deciduous trees very good for trees lately set. The Transcendent and the Ben Davis are the hardiest trees, but I have had none kill back, though many die altogether. My Ben Davis bore the third year from setting.

I grow Black Cap raspberries, strawberries, currants and goosberries (English).

Mr. Glidden: Are peaches ever grown here?

Mr. Rose: I know of but four trees and they have not bloomed. One, a seedling, is five feet high and thrifty; two on hills near us hold their leaves longer than the trees down here. The hills are not frosted as early in the fall as the lowlands.

Mr. Funch: I have picked one and one-half bushels of peaches from two trees on my farm 110 feet higher than this, in South Branch township. They have not borne for two years because of cold winters, but the trees are not killed. They are seedlings. I raised 22 bushels of apples last year.

Mr. Steckert: Around Houghton Lake they raise apples and plums successfully.

Mr. Rose: In New York I set some trees in half dirt and half old leached ashes. They grew little or none. Next spring I washed all but three with strong lye, as strong as for soap, and mulched with leached ashes, both with good effect.

Mr. Funch: I find wood ashes improves fruit.

Mr. Glidden: Ashes only benefit through the roots. Trees naturally have rough bark which should not be scraped off.

Mr. Funch: My washing was not to scrape off the bark but to wash off a black scum.

Dr. Beal: Probably it was small bark lice that the wash took off.

Mr. Rose: There are pores in the bark and if they become grown up it is well to wash it.

Mr. Steckert: Would Mr. Glidden slit the bark of a tree?

Mr. Glidden: No, I see no use in it.

Dr. Beal: As to bark of trees. A good healthy tree has, when several years old, an impervious layer of cork around it which won't even let liquids out of a bottle, and fertilizers must be applied to the roots.

My effort in experimenting here has been to test varieties of grass and clover and forage plants on one rod square plots, some sown late, and no fertilizer used. We sowed 90 to 100 species. I have yet more kinds to try from Iowa, from Russia and elsewhere.

We have also tried many trees from Russia and elsewhere, 6,600 of them, planted in rows as corn is for cultivation.

In Germany, 100 years ago, they began planting trees, and now find those white pines that they imported from this country a most valuable timber tree.

In Walton, Oscoda and Baldwin I tried plats of spurry, clover, timothy, Orchard grass, Rye grass, Alsike and others, singly and mixed, and so far find all the mixtures better than any single kind.

Another trial was to sow ten kinds on ground with no preparation.

At Harrison we rented an old piece that was thin, jack pine land that had been cropped six seasons running, until the land was pretty well run out and discouraged, as was its owner. We want to see what we can do with

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this piece. There we also had given to us a new piece of unbroken land to try on, but have not had time to make much progress as yet.

Dr. Palmer: Does Dr. Beal think Black walnut would do well here?

Dr. Beal: I think not. It always thrives chiefly on strong land.

Dr. Palmer: I planted some nuts a few years ago and they all came up and froze back about one-half each year, and in four years the roots went down three and one-half feet and were three inches in diameter, while the top was but three-quarters of an inch in diameter, and only four feet high.

Dr. Beal: Have chestnuts been tried?

Mr. Harder: I set out 13 in 1886, and last spring all but three were dead.

Dr. Beal: Last fall I bought six quarts of chestnuts and shall plant them here next spring. I planted some Russian mulberry here last year, but have very little expectation of their proving valuable.

Prof. Taft: The Russian mulberry serves to draw birds away from garden fruits. Trees on rich soil, in three years, increased from one inch in diameter to three inches, in Missouri.

Mr. Silsby, for the Committee on Resolutions, presented the following report which was unanimously adopted and the Institute adjourned:

We, the Committee on Resolutions, would most respectfully submit the following:

Resolved, That the organization of this Institute, and the attendance thereof, is of the most substantial value to us as farmers.

Resolved, That we earnestly desire the Agricultural Society at this point to take some decisive steps to stimulate action among the farming community in this locality. To this end we recommend that at least four meetings be held each year in various locations in the county to discuss the agricultural interests of the county and to compare notes with each other as to our successes and failures, so that the best methods may be adopted.

Resolved, That we most highly appreciate the efforts of the Agricultural College in our behalf and in its study of the peculiar problems presented in this region of our State and in the location of an Experiment Station here connected with the College. We can already feel the satisfactory effects of the work of the College in our midst, awakening interest among ourselves and inspiring us with hope of speedy prosperity through more careful treatment of our lands.

J. M. SILSBY,
HUBBARD HEAD,
W. O. BRADFORD,
WM. WOODBURN,
Committee.

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BIG RAPIDS INSTITUTE.

PROGRAM.

THURSDAY, FEBRUARY 7, 7 P. M.

Music.....Arranged by Mrs. H. M. Trussell.
Prayer.....Rev. Henry M. Johnson.
Opening Address.....Hon. J. T. Escott.
Response by Hon. Edwin Willits, President of the State Agricultural College.
Good Literature in the Common School and at Home, Prof. E. J. McEwan, Agricultural College.
Music.
A Letter to the Young People.....Mrs. Anna G. Pease.
The Codling Moth and the Plum Curculio, Prof. A. J. Cook, Agricultural College.

FRIDAY, 9 A. M.

Music.....Forest Grange Choir.
Prayer.....Rev. J. W. Miller.
Stump Land Farms.....Hon. Wm. Ladner.
Discussion Opened by Dr. W. J. Beal, Agricultural College.
Forestry.....Dr. W. J. Beal.
Music.
Green Manures.....Joseph Smith.
Silos.....Prof. A. J. Cook, Agricultural College.

1:30 P. M.

Music.....Arranged by L. L. Blair.
Country Roads.....Prof. R. C. Carpenter, Agricultural College.
The Farmer's Account Book.....W. L. Martin.
Woodwork in the College Shops.....H. Campbell, Agricultural College.
Ten minute papers on Profitable farming for this County:
1st. Crops.....W. C. Philleo.
Discussion opened by.....G. W. Warren.
2nd. Cultivation.....Fred Ladner.
Discussion opened by.....John Martin.
3rd. Implements.....W. J. Sloss.
Music.
Advantages Enjoyed by the Farmer's Wife.....Mrs. Joseph Smith.
Discussion opened by.....Mrs. Bennett.

7 P. M.

Music, arranged by.....Messrs. Dawson and Webster.
Health Hints.....Dr. F. J. Groner.
Discussion, opened by Prof. A. J. Cook.
Ten minute papers on The Best Breeds of Stock for this County:
1st. Farm Teams.....Col. N. H. Vincent.
Discussion opened by.....E. P. Shankwiler.
2nd. Cattle.....John R. Snyder.
Discussion opened by.....C. F. Richardson.
3rd. Hogs.....John Dalziel.
Discussion opened by.....A. Vangilder.
Music.
The Farmer, his Cousins and his Friends.....President Willits.
Reports of Committees.
Music.
Discussions limited to five minutes.

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ADDRESS OF WELCOME.

BY HON. J. T. ESCOTT.

PROFESSORS, LADIES AND GENTLEMEN:

As President of this Farmers' Institute, I extend to you, on the part of the city and county, a hearty welcome.

When we look back to the time when some of us were boys and girls on the farm, what a contrast! Then intelligent people thought that any lunkhead of a boy or girl would do to make a farmer or a farmer's wife, and that the brightest children should be educated for professors.

Now the impression is that the brightest children make the best farmers or farmers' wives.

Mecosta county is fast coming to the front as an agricultural county. A few years ago lumbering was the main business, and farming a secondary occupation, and everything raised or produced on the farm during the summer was skinned off and taken to the lumber camps in the winter. But our forests are fast receding and we must devote more time to the cultivation of the soil.

The first white settlers within the limits of what is now known as Mecosta county located about 1851. The first wedding was in 1854. The first white child (Alice Brockway) born in Mecosta county was born in what is now the fourth ward of this city, July 20, 1852. The first winter wheat was two acres, sown in 1854 by James Montague, who still resides on his old farm in the township of Green. The first saw-mill (the old red mill at the foot of Michigan avenue) was built in 1856. The first weekly mail service (from Greenville) was established in 1857; prior to that time the nearest postoffice was Croton, 28 miles distant. The first school-house (a log one) was built in 1858. The first newspaper (the Pioneer) was published in 1862. The first religious services were conducted by Rev. Kelley, about 1862. The first church (the Methodist, but built as a union church) was erected in 1865.

Today we find large farms, good orchards, large barns and comfortable houses; improved stock of every description; churches of almost every denomination; free schools, well conducted, all over the county; good roads, with railroads reaching out in every direction; telegraph and telephone communication with other cities; two daily and six weekly newspapers giving us the news of the world; and agricultural and manufacturing developments going on. Surely Mecosta county is on the high road to prosperity.

Friends, again we welcome you.

RESPONSE.

BY PRESIDENT WILLITS.

MR. PRESIDENT, LADIES AND GENTLEMEN— * * * Your county had its first impetus from lumber and you thought it was making you rich, but you were mistaken there. You were despoiling your county, and I venture to say that a large proportion of the profits of lumbering have been taken elsewhere to spend.

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But when you develop the agriculture of your county you are increasing your permanent wealth. From all that you hear of the lumber and salt of Saginaw county, you would hardly imagine that agriculture is a greater interest in that county in dollars and cents than the salt and lumber combined, yet such is the case.

We had an institute here ten years ago, but you were logging then and farming chiefly with guns and fishing rods—poor farming implements—and so little came of that institute; but I trust that this effort will result differently—that it will induce you to organize yourselves, so that this institute shall but be the first of a regular annual series, to be held under your own auspices and efforts—institutes which will do you more good than any that outsiders can bring to you.

FORESTRY.

Following Dr. Beal's article on this subject was the following discussion:

Prest. Willits: Talking about forestry here seems much like carrying coals to Newcastle, and yet there are points for us to think of—to be on our guard about before it is too late. May there not be lands which are *not* such as we want for agriculture, which may yet be utilized for tree growing? * * * Trees are our protectors against cyclones. They are practicing on this theory in Nebraska and Dakota.

Prof. Cook: I would like to say a good word for the maple forests now standing. A good maple tree is worth thirty cents a year for sugar, or at twenty trees per acre, $6.00 per acre per year which is twelve per cent of a valuation of $50.00 per acre.

Mr. Martin: I think every farmer should save his wood lot for use and for his sugar bush. Cut your old trees for your own wood, but don't slash down your best trees and come to town and stand around in order to sell your wood for just about what the labor amounts to. We make a mistake trimming out the small growth in our wood lots. If we do that the old trees will soon be dead and there will be nothing to succeed them. The young growth will replace what you cut and maintain a permanent grove.

Dr. Beal: That is just right. Another point is, if you are setting or planting a timber lot, don't set all black walnuts or all of any one variety of timber, but set as great a variety as you find in the natural forests, with some evergreens that stand the shade well, in order to shade the surface and hold the moisture in the ground.

Prest. Willits: What is the best aspect for a timber lot?

Dr. Beal: You must be guided by the lay of your land and that of your neighbors, in each case using judgment. In many portions of Michigan where the farms are in sections a mile square it will usually be best to leave the wood lot at the back end of the farm, thus grouping all the timber on the farms of the entire section, so that the trees on one farm are contiguous to those on other farms, forming mutual protection.

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LAKE ODESSA INSTITUTE.

PROGRAM.

MONDAY, FEBRUARY 11, 1889.

Evening Session, 7 P. M.

Music.
Prayer.
Music.
How Shall I Increase and Keep up the Fertility of my Farm.....Henry Stinchcomb.
How to Make Home Attractive.....Mrs. M. A. Wachs.
Factors of a Good School.....Prof. H. R. Pattengill.

TUESDAY, FEBRUARY 12, 1889.

Morning Session, 9 A. M.

Butter-making on the Farm.....A. B. Johnson.
The Nobility of Labor.....Dr. E. M. Bradford.
Horticulture.....Prof. L. R. Taft.

Afternoon Session, 1:30 P. M.

Manual Labor at the Agricultural College.....H. T. French.
Industrial Education.....President Edwin Willits.
Feeding Steers and Experimental Farming.....Prof. Samuel Johnson.

Evening Session, 7 P. M.

Farmer and Wheel.....Mrs. H. F. Walker.
Window Gardening.....L. A. Bregger.
Treatment of Horses.....Dr. E. A. A. Grange.

QUESTION BOX.

Question: Can alfalfa be grown to advantage here?

Prof. Johnson: It is not much grown in the State. We have an acre at the College that looks well. We got our seed of Albert Dickinson for $6 per bushel in Chicago.

Question: Does rye in a corn field for late pasture pay?

Answer: Yes, sow in middle or late August.

Question: How deep should drains be in an orchard?

Prof. Taft: Three and one-half to four feet.

Question: How kill Canada thistle?

Mr. French: Salt, a handful on every plant.

Question: How kill milk weed?

Answer: Dig up before it goes to seed.

Question: Would you cook feed for hogs?

Answer: No, it don't pay in fall and winter. In summer when fattening for market cook pumpkins, apples, etc., and add meal. Feed swine or cattle shelled corn from barrel self feeders.

Question: Is artificial coloring of butter for market good?

Mr. Johnson: Anatto, yes, in winter.

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Question: How interest farmers in agricultural fairs?

Mr. Stowell: Establish a grange in each town.

Mr. Wachs: By paying all our own expenses and giving all the premium money to some outsider for a fast horse.

Mr. English: By suppressing all side shows and making it a purely agricultural fair.

Mr. Johnson: We had better all unite heartily with the Ionia fair.

Question: Is the interstate commerce bill beneficial?

Prest. Willits: It depends on where you live. If near a strong competing point, no. If not, yes. The object of the law is to prevent discrimination. To prevent charging more for a short than for a long haul. All the people west of Chicago fought the bill, because without it they were able to get as good prices as you in Michigan, in spite of their being 600 miles farther away. Again, the law says they shall not charge one person more in order to deadhead another.

Question: Is it fair to tax mortgages?

Prest. Willits: Yes. The only trouble is to make the tax stick on the holder of the mortgage.

Question: What is the cost to graduate at Agricultural College?

Prest. Willits: About $109 per year pays College bills, including board, and $150 to $200 will cover everything. We make nothing out of them.

Question: Can we send our daughters there?

Prest. Willits: We have a few, but we have no accommodations for them. We would not modify our course for them, as I think the education that is good for the boys is good for the girls.

Question: What is the effect on the mental powers of the manual labor?

Prest. Willits: I will take 100 Agricultural College boys, 100 Normal School boys and 100 University boys, and the Agricultural College boys will hold their own with the others. The College boys have good appetite, good blood, and good power of study. The students elsewhere try to gain this result by gymnastics and do themselves more harm than good by the irregular character of the exercise.

Mr. Johnson: I had a friend who went there as a student who wrote me that he studied in the forenoon and worked in the afternoon, and it occurred to me that this work would cure the ills of students—indigestion, nervous prostration, etc.

Prest. Willits: Just so.

Question: How destroy wire worm?

Mr. French: Prof. Cook recommends trying a buckwheat crop.

Mr. A. B. Johnson: I had a piece where three crops had been destroyed by wire worms, and I plowed it once the day before a very cold night and had no more trouble, I think they froze.

Mr. Stowell: They have troubled me, but by manuring corn I got ahead of them.

Mr. Hosford: I have exterminated them from an orchard by turning over in the spring and sowing to buckwheat and repeating the same the next year and it finished the job. They can't live on buckwheat and that kills out everything else.

Question: Why don't you pay more than eight cents for student labor?

Prof. Johnson: The Board of Agriculture have judged that to be all it was worth.

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Question: Why did Mr. Harrison feed corn meal to get cream?

Prof. Johnson: Because corn contains fat, and to get cream or butter we must give a food that will furnish the supply. For milk we need more nitrogenous elements.

Mr. Friend: Can animals be fed to sell at one year old?

Prof. Johnson: Yes, sir.

BROOKLYN INSTITUTE.

PROGRAM.

THURSDAY, FEBRUARY 14, 1889, 7 P. M.

Prayer.....Prest. Willits.
Opening Addres.....President of Institute, H. A. Ladd.
Music.
Home Culture.....Mrs. Belle Crowell.
Horse Breeding.....C. A. Blackmar.
Small Fruits.....Mrs. R. D. Palmer.
Music.
Our Schools.....Prof. H. R. Pattengill.

FRIDAY, FEBRUARY 15, 9:30 A. M.

Music.
Pin Money.....Mrs. Allen Dunn.
Improvement of Public Highways.....Prof. R. C. Carpenter.
Practical Farming.....J. D. Reed.

Afternoon Session, 1:30 P. M.

Our Soils, Their Needs and How Supplied.....Hon. L. D. Watkins.
Feeding Steers of Six Different Breeds.....Prof. Samuel Johnson.
Music.
Breeding and Selection of Seeds.....Charles Crandall.

Evening Session, 7 P. M.

Music.
Home Conveniences.....Mrs. D. C. Blair.
Agricultural College.....Pres. Edwin Willits.
Music.
Skeleton Diseases of Horses.....Prof. E. A. A. Grange, V. S.

PRESIDENT'S ADDRESS.

BY H. A. LADD.

Brooklyn, Feb. 14, 1889.

LADIES AND GENTLEMEN:

We have met together as representatives of the oldest of human industries. We honor it not only as the most ancient industry, but the one that employs more capital and engages more and better men and women than all others combined.

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History teaches us that the countless empires that have flourished and fallen since man began to war on man, have risen as agricultural, pastoral and manufacturing nations, and fallen when some despotic ruler has ignored the rights of his husbandmen and placed them tributary to his wars and warriors.

To Rome belongs the crown of warlike glory. Under Cæsar she stood proud conqueror of the whole world, while today she sends us the most degraded and despised of all civilized immigrants who seek our far too hospitable shores.

Greece, Persia, Carthagena, her fair sisters in glory and misfortune, are but sad examples of the policy of degrading agricultural industry.

The very life of a nation is as dependent upon the intelligence of her agriculturists as the the mountain river to the snow that clothes the eternal hills.

We are told by fourth of July and campaign orators that under our starry flag lives the best housed, best fed, best clothed and best educated agricultural population that the world ever saw. That in our right of ballot we hold the power to control the destiny of the nation. But they don't tell us why we never make any use of this power. They point out the improvements we have made in stock, in methods of growing and harvesting crops, in our churches and school-houses, in our free school system built up under the fostering care of the State, that educates the rich and poor alike, but fail to tell us why we tax ourselves to educate and ennoble the rising generation and then allow the cities and villages to license saloons to entrap and destroy them.

What they tell us of our position is largely true, and we take pride in the fact that the three counties embraced in the territory of this institute stand in the front ranks as producers of wheat, oats, corn and clover, in blooded cattle of all breeds, fine horses, registered sheep and swine, well fenced farms and fine farm buildings, and greater than all, our grand and glorious men and women. We feel an honest pride that our sister State, Wisconsin, has chosen from her husbandmen for governor that matchless dairyman, W. D. Hoard, while our own State Senate is presided over by our brother farmer, of small stature but giant intellect, Hon. Wm. Ball, of Hamburg, and we have for chief executive that twice honored "grand old granger from Gilead," Cyrus G. Luce.

We realize the grandeur of our position, yet wish to make it still more grand.

It is our aim to increase the productiveness of our farms, have more convenient houses and commodious barns, and have well bred stock of all kinds so plenty that the name of scrub shall be heard no more, and while engaged in raising fine stock and growing better crops, each year we wish to raise the mortgages from our farms. We also wish to raise statesmen to fill the halls of our legislature that will change our laws of taxation that now allow a lawyer with an annual cash income running way up into the thousands to go untaxed, while the poor farmer, with his farm mortgaged for all it is worth, has to sell his last cow to pay the taxes on something he doesn't own.

Realizing full well the superiority of our agriculturists over those of other nations, we also know that difficulties are gathering round our path as thick as stars along the milky way.

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Shall we sit with folded hands waiting for Fisk's "twentieth century man" to lead us out from under the cloud of trusts that are gathering thickly around and over our way? No, let us gird on the armor of manhood, and march forth to the battle of life under the starry banner of freedom, bearing for our motto those grand words of Lord Byron to the Grecians, "Who would be free themselves must strike the blow."

Let us not be the last to demand that the trust and combinations of capital that control the price of what we sell and what we buy shall be destroyed as we destroy the parasites that feed upon our crops.

May we strengthen and extend our farmers' organizations till we make this a government of the farmers, for the farmers and by the farmers.

[A large number of good papers were presented, which as they are not of a specifically local character can be found grouped according to subject, by reference to the index.—H. G. R., Secy.]

CENTREVILLE INSTITUTE.

PROGRAM.

MONDAY, FEBRUARY 18, 1889, 1:30 P. M.

Music.
Prayer.
Address of Welcome, by the President.....S. H. Angevine.
Response.....Pres. Edwin Willits.
Management of Live Stock.....Richard Dougherty, Colon.
Manual Training and Technical Schools..James Wiseman, Agricultural College.

Evening Session, 7:00 P. M.

Music.
Prayer.
Question Box.
Literature in Home and School.....Prof. E. J. MacEwan.
Recitation.....Miss Marguerite Woodworth, Battle Creek.
Raising and Management of Hogs.....Gideon Hebron, Constantine.
Insects and How to Fight Them.....Prof. A. J. Cook.
Music.

TUESDAY, FEBRUARY 19, 1889, 9:30 A. M.

Music.
Prayer.
Question Box.
Care and Management of Young Stock.....Levant Strong, Vicksburg.
Farmer as a Mechanic.....Prof. W. F. Durand.
Forestry.....Prof. W. J. Beal.

TUESDAY, 1:30 P. M.

Music.
Prayer.
Question Box.
Production of Wheat.....George Osborn.
Potato Culture.....L. A. Aspinwall.
Silo and Silage.....Prof. A. J. Cook.

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Evening Session, 7:00. P. M.

Music.
Prayer.
Question Box.
Paper.....Lieut. W. L. Simpson.
Recitation.....Miss Marguerite Woodworth.

PRESIDENT'S ADDRESS.

BY S. H. ANGEVINE.

LADIES AND GENTLEMEN:

We have met on this occasion to compare ideas and experiences that our store of information regarding the science of agriculture may be advanced. It has been said that "all knowledge comes originally from observation. The discovery of all new facts, the establishment of all general principles, all progress, all advancement, all improvement is the direct result of observation." Observation is the parent of imitation. We are a world of imitators, constantly grouping together old principles to produce new effects, and these effects constitute the improvements of our present advanced state of civilization.

Strictly speaking, the production of a new thought or idea is an exceedingly rare occurrence; but the individual observer will each day see something which is new and of interest to himself, and it is for the comparison and criticism of these individual observations and ideas that we are assembled at this time. The most grievous hindrance to successful agricultural operations at the present time is a lack of sufficient rain-fall to mature the crops in their natural condition. The ancient Egyptians were compelled to resort to the practice of irrigation in order to sustain their immense population. The adoption of this ancient practice has proved successful in our own country where mountain streams can be conducted and distributed to the valleys below. The Romans, who were also afflicted with dry seasons, sowed their wheat in drills, the rows being of sufficient distance apart to admit of hoeing by hand, which was several times accomplished with good results. With the facilities at our command in the way of improved machinery and implements for tilling the soil, the Roman plan of wheat culture might be adopted by us with profitable results. Situated as we are upon the level plains, the scheme of irrigation is entirely impracticable, as the expense would amount to more than the profits. Our once numerous forests have yielded to the woodman's ax until few barriers are left, and the blighting winds and scorching sun wither and destroy vegetation, perhaps as a punishment to man for his misuse of one of nature's greatest gifts. However, if we have a continuation of seasons of almost perpetual drought, which is not at all impossible, we should rely to some extent upon a more thorough cultivation of the soil, as a partial remedy. The subject of rainfall will sometime be critically examined by scientists and experimentalists, and some known facts relative to concussion of the atmosphere will be examined. Science has revealed much, and will reveal more, as conditions and circumstances demand. The degree of success to be attained in the future of American agriculture must depend largely upon scientific and experimental revelation. The field for such

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labor is broad and the laborers are few, but ideas of higher and intellectual attainment are rapidly gaining ground, and it is only a question of time when the majority of the young will avail themselves of the opportunity for a higher education which is now so freely offered by the public institutions of our State. * * * * * * * * * * *

QUESTION BOX.

Question: Why can't we have a farmers' institute here every year?

Mr. ——: At the institute held here by the College 12 years ago an organization was created for the purpose of holding annual institutes and there was one held the year following, but the attendance was light and the thing dropped there.

Hon. Thos. Mars: Twelve or thirteen years ago, at our place, we had a State institute, at the close of which we appointed a committee, with president, secretary, and executive committee of five, and have held an institute each year since, and all very successful, this year with an attendance of 400 for each of eight sessions, and I would recommend every county in the State to follow this plan.

Prof. Cook: It seems to me that our institutes fail of their purpose unless they result in a continuing series of institutes. In Kalamazoo county they circulate around from town to town, and are most successful.

Question: What can we use in the place of clover to keep up our lands?

Lieut. Simpson: In Arizona they grow alfalfa that cuts five crops a year of two tons per acre each.

Dr. Beal: Alfalfa takes two years to get going. It wants deep, open, porous soil without clay bottom, and must be sown alone. Perhaps you fail with clover because you sow it with other crops; try it alone.

Mr. Sharp: I tried that on my thinnest and poorest land that had been in corn two years. Plowed in fall and dragged. Sowed in April and dragged afterwards with slant-tooth harrow, and it succeeded very well indeed. It first came with some patches of sorrel, but it got the better of that afterwards. On our good lands I think we need have no trouble, but on poor land we must sow it alone.

Prof. Cook: I want to seed clover and timothy with wheat, but think it can only be done with liberal stable manuring. On a piece of mine where a strip was accidentally neglected in timothy sowing the clover was very much better than over most of the field.

Dr. Beal: Don't forget that June clover is biennial and will die out after the second year unless allowed to go to seed and thus reseed itself.

Question: How can we clear an 80 acre farm of a $2,000 mortgage?

Dr. Beal: A Barry county farmer had a $2,500 mortgage. He sent his boy to the Agricultural College, and then by his help on the farm paid off the mortgage and bought another 40 acres, and they are now clear of debt and prospering—this by selling milk and making maple syrup.

Mr. Sharp: Any good man can pay off a $2,000 mortgage from 80 acres of good land in St. Joe county.

Question: Can grain be profitably grown without a well-fed manure pile?

Prof. Cook: In the New York institutes their main topic of conversation is how to develop the manure pile, and they discuss feeds as much with reference to their value for manure as for beef making.

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Mr. Dougherty: I have always been very careful of my manure. To throw it under the eaves to leach and fire-fang is to throw it away. The best way is to haul it out as fast as made and spread on the grass fields. I know of no better way to make use of it. Spread with a manure spreader and it will not trouble you when you mow. The more manure we make the better. In England, if they can get the cost of their feed in selling their stock, they consider themselves paid, and call the manure good pay for their labor. I have not used a manure spreader myself, but think well of them, and would recommend two neighbors to keep one and use it together.

Mr. Sharp: Suppose a man tries to fertilize by stable manure, how much of his land can he cover per year? Is not clovering cheaper?

Mr. Sadler: My brother-in-law farms 400 acres in Iowa, and composts his manure with earth, and then when thoroughly rotted scatters with a spreader.

Mr. Angevine: The Kemp spreader distributes the manure just as it is put into the spreader. Peppermint straw is worth $4 or $5 a ton as feed for stock, so that it is too expensive to rot down as bedding.

Question: Can a $2,000 mortgage be raised from an average 80 acre farm by an average farmer?

Senator Mars: The impression has been given that this could be easily done. It seems to me that for most farmers the best thing to do with such a mortgage on 80 acres would be to move off and try to start fresh on cheaper lands. I find the mortgage ridden farms are grinding out the lives of the women on the farms. If you have not money enough to buy 80 acres, buy two acres or whatever you can pay for, but don't weight yourself down with a burden of debt. If you have such a debt get rid of it by letting the mortgagee have enough of the land to pay the debt and live yourself on what remains.

Question: How make kerosene emulsion?

Prof. Cook: Take one quart soft soap or one-fourth pound hard soap, one quart water, one pint kerosene, mix and stir very thoroughly and then add five quarts water.

Question: How kill lice on cattle?

Prof. Cook: Sprinkle with dust in summer, or coal ashes in winter, or use kerosene emulsion, or take one pound of 10 or 15 cent tobacco in a pail and add two gallons boiling water. Then swab all over the animal, which need not take ten minutes; blanket if the day is cool. Once is usually effective. If Buhach is used, two or three times is usually effective. Some animals seem especially lousy and need to be washed two or three times in a winter.

Question: How kill cabbage worm?

Answer: Buhach, which can best be bought of the Buhach Manufacturing Co., Stockton, Cal., is better than hellebore.

Question: Should farmers pay taxes while they are as unequally levied as at present?

Passed.

Question: How long will Michigan submit to unjust legislation?

Prof. Cook: It seems to me farmers have a grievance in that they pay interest on mortgages and pay taxes on the whole land. How get it righted? Through farmers having more influence in legislation. Let the grangers unite their force. Why not let the farmer pay his full tax, but receive an

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acknowledgment therefor that shall serve by law as a receipt of payment on account for interest on mortgage?

Senator Mars: This is no simple or easy question. The legislature is in the main an honest and well intentioned body who desire to do the best thing for the State, but if you would go to Lansing you would find the moneyed interest represented by lobbies and petitions, while the farmers are noticeably silent. Let the grangers see that their views are heard by the legislators, that their wishes are expressed in petitions and by agents. This present law of mortgage taxation is in so far better than what preceded it, but perhaps the California law is better. There mortgages go scot-free and the tax is assessed on the farms, but a double receipt is given in case of a mortgaged farm, one receipt for the value of the mortgaged part and one receipt for the value above the mortgage, and it seems to work well.

Mr. ——: My opinion is that our present tax law is worthless. If I own but one-half of my farm and a mortgage holder owns the other half, he may live in another State, and there be no way of reaching him except as suggested by Mr. Mars. Even then the lender can stipulate in his bond for the payment of the whole tax by the debtor.

Question: What would be an average yield of mangel-wurzels?

Dr. Beal: Five hundred bushels on the average. You might get 1,000 to 1,200 bushels in exceptional cases.

Mr. Strong: We only raise small patches of one-half acre or thereabouts and get perhaps 20 tons per acre.

Mr. Angevine: Mr. Sweet of Grand Rapids says twelve to twenty-five tons, according to kind and circumstances.

Question: Does the English sparrow give the cattle lice?

Prof. Cook: No.

Senator Mars: In some localities in Kansas, in '57, bats did carry bed bugs from the bark of the cotton wood trees, on which the bed bugs were in immense numbers.

Prof. Cook: I think Mr. Mars must have mistaken some other insect for bed bugs.

Mr. Mars: Was Prof. Cook ever in Kansas?

Prof. Cook: Oh, yes.

Senator Mars: I remember stopping there at a house, and the man said he had stopped hauling rails because the bed bugs swarmed so. They may not have been bed bugs, but they bit like them and smelled like them.

Question: Will Alsike stand drought better than June clover?

Dr. Beal: No, not as well.

Question: How about Alfalfa?

Dr. Beal: We have tried small lots for 15 years, and it wants light soil with open subsoil and stands drought very well indeed. It will not do to sow with other grasses. It is a perennial, takes two or three years to get started and then lasts 15 or 20 years, and must be cut several times a year, and makes as good hay as clover. It would be well in starting it to sow in drills and cultivate at first.

Lieut. Simpson: It is a splendid forage for horses.

Question: Should we cultivate corn while earing?

Senator Mars: It depends on the weather. In dry time cultivate weekly till the grain is well formed. In the west they advocate shallow cultivating. I have no experience on the question of depth.

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Mr. Dougherty: Cultivate well before planting. Harrow before up with a slanting tooth harrow. Then cultivate pretty deep as soon as up and as it grows, don't cultivate so close to it as to hurt the roots, and don't cultivate too deep.

Mr. Osborn: I have seen late culture do decided injury.

I like to go through three times as soon as I can and to let it alone afterwards. It is a mistake to destroy those rootlets, of course if you do so the plant will try to send out more, but you have taxed its powers just so much. I believe with Mr. Dougherty in gradually cultivating more and more shallow as the season advances.

Senator Mars: In Missouri, they cultivate corn twice, and the sun flowers and cockle burs fill up between the rows. I know a piece of corn where part of a field was cultivated by boys three times only and allowed to rest in harvest and a man cultivated the other part right through a dry harvest season. He got 50 bushels and they 16 bushels per acre.

Mr. Osborn: How is it possible to get moisture into the ground by cultivating?

Dr. Beal: Cultivation keeps the surface mellow, and that acts as a mulch and retains the moisture. I would recommend shallow culture in such cases. That moisture does escape from an exposed soil is shown by inverting a glass over the soil; drops of moisture will gather on the inside.

Mr. Langley: A neighbor raised 60 bushels per acre in Colon and said he did it by keeping the cultivator going right through the season.

The different representatives of the Agricultural College then gave some account of its various features, after which resolutions were adopted opposing the repeal of the Agricultural Statistics Law and advocating the change of the law as to appointment and remuneration of the circuit court reporter.

By resolution a committee was appointed on institute for next year, consisting of Mr. J. C. Dougherty, Mr. D. Handshaw and Mr. John Wolf.

ALBION INSTITUTE.

PROGRAM.

WEDNESDAY, FEBRUARY 20, 1 P. M.

Music.
Prayer.
Address of Welcome.....J. Wartman, President Farmers' Club.
Our Country Schools.....Mrs. Henry Bradley.
Music.
Industrial Education.....Hon. Edwin Willits, M. A., President Agricultural College.

Evening Session, 7 P. M.

Music.
Prayer.
Mechanics in Relation to Agriculture..W. F. Durand, Ph. D., Prof. of Mechanics, Agricultural College.
Sandy McDonald's Signal.....Mrs. C. Reynolds Smith.
Music.
The Nation's Wards.....W. L. Simpson, Lieut. U. S. A., and Prof. of Military Science and Tactics, Agricultural College.

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Forenoon Session, Feb. 21, 9 A. M.

Music.
Prayer.
Free Text Books for our Country Schools.....S. Gorsline.
Some Problems.....Mrs. J. B. Gemberling.
Music.
Relation of Yield to Profit or Limit of Profitable Increase..Eugene Davenport, Assistant Prof. of Botany, Agricultural College.

Afternoon Session, 1 P. M.

Music.
Prayer.
Essay, The Farmer's Rights.....D. A. Shaffer.
Thought Culture.....Mrs. T. C. Anthony.
Music.
Diseases Peculiar to the Bones of Lower Animals.....E. A. A. Grange, Prof. Veterinary Science, Agricultural College.

This institute, the last of the season, was very well attended, and devoted largely to educational questions. The papers, so far as they reached the Secretary, will be found by reference to the index.

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LECTURES AND ESSAYS READ AT FARMERS' INSTITUTES.

ROAD CONSTRUCTION.

BY PROF. R. C. CARPENTER.

Read at the Flint Institute, January 30, 1889.

In the short paper that follows I will make no attempt at a scientific explanation of the principles and processes of road building. On the other hand I will give you a few detached notes of points in road construction that have been of interest to me, and that I deem worthy of your attention.

In the first place, our country has the reputation of making very poor roads, and the reason for this is to be found in the fact that we, as a public, give little thought or attention to the roads. Our roads might be made the best in the world could the people be made to take pride in them, and to invest money in them.

Since the invention of the railroad, the common road has ceased to be of as great importance in a commercial sense as before. Our common roads are no longer great trunk lines, bearing the traffic of hundreds of miles of territory; but on the other hand are feeders to the railroad, and seldom of importance to more than ten or twelve miles of area. There is every reason to think that common roads will always be needed; no one believes that railroads, or even tram-ways can be built in the place of each common road, although it is hard to predict just to what extent railroad building will be carried.

Let us examine the question a moment to see what we can afford to pay for improved roads. Now, it is probably true that it will not pay to spend a great sum of money in the improvement of our common roads, yet I think we will find that it will pay to improve them to a much greater extent than has been done in the past. I call your attention to the following table which I compiled some years ago, as it shows the comparative value of the different kinds of roads. It also gives the loads, in tons, that form complete loads for ordinary horses. I may say, in this connection, that whereas the day's work for an ordinary horse, taken year in and out, is only equivalent to a steady pull of 100 pounds for ten hours, at a speed of two and one-half miles per hour, yet it is probably true that many of you have horses capable of doing somewhat more work. The cost of transportation is calculated on the assumption that wages of man with team and wagon are $2.50 per day; which furnishes a means of comparison of the different roads, but except in a few cases it will not give the exact cost of transportation:

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Kind of Road.	Level road—proportion that resistance bears to whole load.	Load for two horses.			Cost per mile, assuming cost of wagon, team and driver $2.50 per day. Distance 25 miles.		Maximum distance wheat worth $1.00 per bushel can be drawn. Miles.
		Gross load in tons.	Net load. (Two-thirds of gross load.)				
			Tons.	Bushels.	Each ton.	Each bushel.	
Smooth stone pavement	1-68	6.8	4.52	151	.022	.0007	1,430
Broken stone road on rock foundation	1-49	4.9	3.27	109	.031	.0009	1,111
Broken stone road on earth foundation	1-34	3.4	2.28	76	.044	.0013	770
Gravel road	1-15	1.5	1.00	33	.100	.0030	333
Good earth road	1-11	1.1	0.73	25	.137	.0041	244
Common sandy road	1- 7	0.7	0.47	16	.213	.0064	172

The least cost of a gravel road containing 3,520 cubic yards of gravel per mile, under the most favorable conditions, will probably be not less than $800 per mile, $400 of which should be expended in each of the first two years. Under some conditions the cost will amount to four or six times this amount. If the road is well made the cost of annual repairs will be small, say for the next eight years $50 per mile, that is, a man and team at work constantly, would keep in repair fifteen miles.

This would give us an average annual cost during the first ten years for a good gravel road of $130 to $530 for each mile. For a second term of ten years its cost per mile would be less. A broken stone road would give an average cost of probably twice this amount for the first ten years, whereas, for the second term of ten years its cost would probably be less than that of a gravel road. The figures would indicate a greater economy in a gravel road than is usually supposed. To illustrate this we will take an example which is certainly not unreasonable. Suppose that after a road is improved 20 loaded teams per day pass over the road, carrying per team a load of 33 bushels of wheat or its equivalent, at a speed of two and one-half miles per hour. The traffic over the road would amount to 660 bushels per day, and its cost of transportation would amount to $1.98 per mile (see table) per day. To have carried the same amount over our ordinary country roads would have cost $4.22 per mile per day. So that the improved road gives a saving of $3.24 per mile for each day. If we suppose that this traffic is maintained for 300 hundred days in the year, the saving will be $672 per year per mile, and this will probably not be too high an estimate, for when the common roads are much affected by bad weather in spring and fall, the traffic over the improved road will probably be increased to an extent sufficient to make up deficiencies in the traffic that may occur in the winter season, at which time the cost of transportation is about the same over common and improved roads. If the average cost of gravel roads be taken as $250 to $400 per year for each mile, the saving with the small traffic specified, viz., two teams each hour, is enough to pay the cost and a good interest (50 to 160 per cent) on the investment. Such considerations as these tend to show that time spent in improving the roads is not entirely thrown away. These figures would

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also seem to indicate that we are paying in extra cost of transportation over poor roads, a tax which would do much toward building good ones. A poor road is a toll collector that needs no gates to exact its dues. All who pass over it must pay in diminished loads and extra time, a tax proportional to its wretchedness. If the general public could be made to feel that waste of time and waste of money are equivalents, and that extra time spent in traveling over the roads could profitably be employed at home, some steps would be taken that would lead to an actual improvement in the condition of our common roads.

If we conclude to improve our roads we must consider some important points.

DRAINAGE.

The first and most important requisite is the drainage. No matter what material you have at hand, no matter how carefully you may apply it, if your road is constantly saturated with water, it will be a miserable failure. The amount of water that the road will absorb without being injured, depends upon the soil. Sandy roads are very much better when thoroughly dampened, but if saturated they are as soft as the thinnest mud. Clay roads are very hard when dry, and at this time present a surface which rivals the hardest gravel. Were it not for the dust which rises from the surface of dry clay roads with the least breath of air, they would be considered equal to our best stone or gravel roads. A wet clay road, however, is an altogether different thing; the hardness which characterized the dry road is no longer to be found, but in its place is a soft jelly-like mass, without a fixed surface, and sometimes without any sensible bottom.

A gravel road affords a ready means of escape for the water that falls upon it, and consequently it is not so much improved by drainage, but when thoroughly saturated with water it is much softened, and very much injured.

In all improved methods of road building, thorough drainage is the important requisite; it forms the first and principal operation in preparing the foundation. The noted road builders of Europe all insisted on this one thing. McAdam, the inventor of the broken stone roads, and Telford, a man who much improved the roads of McAdam, both insisted on thorough drainage of the foundation.

The road surface is the only important consideration so far as the traffic is concerned, for it directly receives the traffic, and forms the resisting medium for our vehicles. It is important then that the road surface be hard and smooth, every rut and every inequality adds both to the draft and to the discomfort of riding. Again, the surface should be as hard as possible.

It has been discovered both by theory and experience that hills increase the draft by an added fraction of the weight of the load that is inversely proportionate to the distance passed in rising one foot. That is, if the draft on a level road of a certain character were a certain fraction of the weight of the load, on a hill of the same character, the increase of the draft would be an added fraction of the weight of the load, having one for its numerator and for its denominator the distance, measured on the slope of the hill, to secure one foot rise.

Thus the added draft would be one-fiftieth of the weight of the load, if

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a distance of 50 feet is required to give a rise of one foot, one-thirtieth if a distance of 30 feet, one-tenth if a distance of 10 feet, etc.

Over different level surfaces the draft varies from one-seventh of the load on sandy soil to one-sixty-eighth on a smooth stone pavement.

Now, if a distance of seven feet gives a rise of one foot, the increase of draft is equal to one-seventh of the weight of the load, which on sandy soil would exactly double the draft of the level road, whereas, on a smooth stone pavement it would be increased from about one-seventieth to one-seventieth plus one-seventh or eleven-seventieths, an increase from the level road of fully ten fold.

On a gravel road the ordinary draft is about one-fifteenth. Now a hill which rises one foot in a distance of 15 feet, would increase the draft one-fifteenth, or just double the draft. From this it is seen that the poorer the road surface the less do hills affect the proportional amount of the draft. Now it is not meant by this that a team can pull a heavier load up a sand hill than a hill of the same steepness of good hard road, but we do mean that the increased per cent of draft is less on the sandy road than on the hard road.

Now it is a fact that horses can exert for a short time twice the force they can maintain throughout the day without any detrimental effect, and from this known fact it has been concluded that the slope of the hills should be such as only to cause twice as much resistance as on a level road. If hills are much steeper than this, the load up the hill must be lessened or the power increased by adding extra horses. Frequently the practical effect of a hill is to lessen the load taken over the whole road; that is, a man will put on to his wagon just such a load as he is certain can be pulled over every hill without unloading a portion. The steepness of hills that will not require extra power would be as follows: Common sand, one in seven feet; good earth, one in eleven feet; gravel, one in 15 feet; broken stone—McAdam, one in 34 feet; broken stone—Telford, one in 49 feet; smooth stone, one in 68 feet. From this comes the practical truth that it requires a steeper hill to double the draft on the poorer road, and again, if a hill does not more than double the draft, it is not a serious objection. We must remember that as our roads are improved the grades of our hills must be lessened. In England, on the famous Telford roads, the maximum rise allowed was one foot in 30 feet. In our railroads the maximum grade is usually one foot in 100.

SECTION LINE ROADS IN RELATION TO HILLS.

In connection with this subject of hills, it will not be out of place to call your attention to the fact that the common practice of running roads straight north and south, or east and west, on section or quarter section lines, regardless of the fitness of the location for a road, makes the task of the road maker a difficult one indeed. Now the bale of a kettle is no longer when laid down than when standing up; so with the roads over the hills, it frequently is no farther around the base than over the top. It is estimated that the work of ascending one foot is the same as of going a horizontal distance of 20 feet, it certainly is equal to going a distance of several feet. There is no doubt but that our roads would be much improved had we the liberty of winding around the bases of hills, instead of climbing up the hills,

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and then climbing down again. This I know can not be brought about, as it would affect the shape of our fields, and in some cases perhaps the boundaries of our farms. I believe, however, it would pay to suffer a little inconvenience in farming from crooked road fences, in order that our roads might have the advantage of more even ground.

The effect of a small amount of grading in improving a road is more than usually supposed. I think no kind of work on the road makes as much showing for the actual labor expended as this. The effect of a couple of feet taken off from a hill and added to a valley below, is to reduce the total undulation about four feet, and make a striking change in the profile of the ground. If more grading were done it would be less dreaded, and more or less must be done before we can secure very good roads in hilly districts. This is usually true, however, and is some offset against the advantage of building roads in a level country, that the more grading is necessary, the less drainage will be required.

HOW TO DRAIN ROADS.

Now as to the method of draining roads: The old methods were turnpiking and ditching. Turnpiking affords a valuable means of drainage; it elevates the road above the surrounding land, and thus permits the water which falls on the road to pass off. When turnpikes are properly made they are of much value, but as ordinarily made their efficiency is small indeed. The surface of the turnpiked road should have a single uniform slope from the bottom of the ditch to the center of the road. This slope should average about one inch to a foot, measured horizontally. It should not be greatest next the ditch and least in the center of the road. The slope of the outside of the ditch should not be steeper than four inches to a foot.

The plow and scraper are the two implements most valuable in making a turnpike road. It will be found that after a turnpike is constructed there is a tendency for the crown to flatten, and even to grow concave, and wheel ruts form on the top. As soon as this happens the drainage of our roads is impaired, mud holes and ruts form, and we find turnpiking no improvement. To remedy this evil we must give the road constant attention, using for this purpose a road machine or leveling scraper, which crowds the dirt back on to the crown and fills up the ruts, thus restoring the convex form to the road. The side ditches demand unremitting attention; they should be made in such a way as to afford an unimpeded water-course for the water from the surface of the road. If they become choked up in places, the value of the turnpike is impaired or destroyed. To clean out the side ditches the same leveling scraper is an excellent implement.

IMPROVED ROAD WORKING MACHINERY.

In the construction of roads two very important inventions have, within the last few years, been perfected, and these are the wheel scraper and the steam road roller. The wheel scraper is a combination of scraper and wagon, so arranged that the team, by drawing the scraper into the earth, can scoop up a full load. This is lifted up on wheels and carted to the dump. It lessens the cost of excavating about one-half as compared with hand shoveling.

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The steam road roller is a costly machine, weighing 20 to 50 tons, its great weight being sufficient to pack a road so thoroughly that it will remain hard for a long time after the roller has passed over it. The cost of such a machine at present is too great to permit its use except in the larger cities.

The road machine, of which there are several kinds, is a very efficient leveling scraper. It is usually adjustable, so that it will level the surface of the earth, and carry the loosened earth either to the side or center of the road. It sometimes has a plow attachment, a novel trimming device, an ordinary scraper and often a roller.

The older road machinery, the common scraper and the plow, need no description. The plow is a valuable tool, but it is used too much. I cannot caution you too much against too frequent plowing of your roads. Do not disturb the surface of a road if once hardened and packed, unless absolutely necessary. Holes and ruts can often be nicely remedied by simply scraping new earth from the sides, or by passing over with the leveling scraper. Every road district should have not only a common scraper, but it should have a leveling scraper; this last instrument is made by setting a tongue obliquely into a heavy plank about 12 feet long, which is shod with a steel plate (an old saw) on its front face and at the bottom. This last implement, rightly used, is a power in the hands of an efficient road overseer.

OPEN DITCHES.

Road drainage with the open ditch is practiced only to a limited extent, and usually when practiced it is used in connection with the turnpike. In very wet marshes the open ditch is a necessity at first, but as it is liable to be filled and not very efficient at best, it is not good policy to depend on it longer than necessary.

UNDER-DRAINS.

The use of the under-drain is principally to remove the water from the subsoil, consequently to be of much value for road drainage it must be combined with a system of turnpiking. Water does not readily pass through some soils when packed or puddled, so that if our roads are built in a convex form the water will pass to the sides, where it may be allowed to enter the under-drains. In constructing the road I would put under each side ditch formed in turnpiking an under-drain of three-inch tile, or one under the center of the road of four-inch tile. The cost of a three-inch tile drain need not much exceed 50 cents per rod. It may be necessary in some stiff clays to cover over the drains with gravel or some porous soil, but usually this will be necessary only for a few feet in each section of seven or eight rods in length.

I am fully convinced that a well drained road, even on common soil, would be in many respects a good road, and it is certainly true that a wet foundation will not allow a good road to be formed with any material whatever. In the process of constructing improved roads we are not ready to apply the road metal—as the covering is called—until our road is in a proper condition to allow the water to pass off. After a properly drained foundation is made, our next step is to apply the road metal, or covering, in other words to form the road surface.

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CONSTRUCTION OF A GRAVEL ROAD.

In the construction of a gravel road, the first requisite is good gravel. Perfect gravel should consist of coarse, clean pebbles, from one-fourth to one inch in diameter, which have such sharp edges that the hand may be scratched by them. This is the model gravel, the ideal which so far as I know is not to be found in any natural deposit. We secure such only by breaking our common "hard head" stones into fragments. But gravel will be found better for road purposes, as it approaches this ideal. A gravel road hardens by a process of packing or wedging, similar to that which takes place with the stones of an arch. This setting is assisted by the presence of a small amount of clay, but is injured by sand or too much clay. In the broken stone roads of McAdam or Telford type, this process of setting is so perfect that the whole surface becomes as solid as though built of one stone.

To construct a gravel or broken stone road on earth foundation, the first step must be, after the grading has been done, to form a properly drained foundation as explained. Our next step should be the addition of the gravel. The common practice is to put on the full thickness of gravel at once, be it eight or twelve inches; this practice is open to the objection that the gravel is so thick that only a portion of it is ever hardened, packed, or set, and that portion just at the surface. Ruts will almost always be worn to a greater or less extent in the surface of new gravel; if these are scraped full with the road leveler, all right, they will fill up and we will get a comparatively good surface. A better method, however, is to put on a layer of gravel about four inches deep, keep this smooth by leveling and allow it to be thoroughly consolidated by the traffic before applying any more gravel. After this first layer has become thoroughly packed, apply a second of the same thickness. If two layers are not sufficient a third may be added. This method has the advantage over the first of having the whole amount of gravel thoroughly packed and hardened. It is not so liable to be water-soaked, consequently it is likely to keep its form and be in a good condition in our worst weather. In the repair of gravel roads, it is emphatically true that a "stitch in time saves nine." If the ruts are filled as soon as they perceptibly show the cost will be small and the effect surprisingly good. There is nothing that increases in size faster than a rut on a much traveled road. It is started perhaps by a little and often imperceptible unevenness in the surface of the road, which causes the wheels to strike the ground with some little force; after it is started the blows from the succeeding wheels falling farther are much heavier and cause it rapidly to increase in size. When the road is wet and soft the effect of the vehicles in forming ruts is much greater than when it is dry and hard, so that our wet roads are our most uneven roads.

In adding new gravel to old gravel, if dry and hard it will be necessary to drag or pick up the surface of the old road for the depth of an inch or two, in order to secure a perfect union.

BROKEN STONE ROADS.

I believe much good may be obtained from broken stone roads. Gravel in many parts of our State is difficult to find and except in a few localities not of good quality for building roads. On the other hand, stones in profusion are found over nearly the whole of our State. These stones, if broken into

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fragments, make the best road material known. In England they employ the genus tramp at the work of breaking stone in pay for his lodging and meals. In this country we have not yet got to that point where we dare say the tramp must earn his living, and consequently have no such facilities for getting stone broken. Yankee ingenuity has, however, furnished us a stone breaker, fully equal to the tramp; armed with steel jaws and worked by steam, it grinds the hard-heads into fragments as easily as you could crumble bread with your jaws. The cost of breaking stone with this machine is about 25 cents per cubic yard.

The method of constructing a broken stone road is exactly as described for a gravel road. Broken stones require a longer time to consolidate than gravel, but finally form a much harder and better road. I am fully convinced that in many portions of the State it would be also a cheaper road. [Note—At Jonesville, Michigan, large quantities of stone are being broken in a stone crusher, and shipped to Ohio and Indiana to be used in making macadamized roads.]

OUR ROAD TAX LAWS.

Our system of repairing and constructing roads, is, as well known, established by the statute laws of the State. This system is so familiar that I need waste no words in describing it. Neither will it be necessary to waste time in any description of how the provisions of the law are enforced.

The law has been bitterly assailed as being erroneous in its fundamental principle of requiring or permitting the tax to be paid in labor. It has been urged, and doubtless with a great deal of truth, that the labor required by the law has not been forthcoming and that even when honestly put forth, most of it was wasted through misdirection. Strong efforts have been made from time to time to change the method of paying road tax, from labor to cash, and with the idea of working the roads by contract. These proposed methods have invariably met with a cold reception in the Legislature, and every effort to change or revise our present laws, so as to make the payment of our road tax in money obligatory, has met with defeat.

This method of paying road taxes in labor no doubt originated in feudal times, when one of the duties imposed on the tenant by the lord of the manor, was to maintain the roads in a passable condition for the troops of the domain.

While the principle of paying road tax in labor has been abandoned almost universally in Europe, since the beginning of the present century, it has been retained by nearly every one of our States, and judging from present appearances it is likely to be retained in our own State for years to come. While the arguments that are advanced against our present system are weighty and difficult to meet, still this fact remains, that there are serious objections to be urged against any system of working our roads by contract. Our system, even if not faulty in its underlying principle, has not given us the results that might fairly have been expected from the labor actually expended. In other words, a certain per cent—in some cases a very large per cent—has been misdirected, misapplied or wasted. It is useless to give exanples of this, there being very few road districts in existence but what have experienced such evils. This results largely from putting in incompetent men as road overseers, and by adopting no general system

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for road construction or repairs. Overseers are changed frequently and each man as he comes into office proceeds to put into practice his peculiar ideas of road construction.

He is generally removed before his system has been completed, and the result is that the public is compelled to travel back and forth over a road that is continually in a partially finished condition. Such a road never improves and the road work is wholly wasted. Against incompetent officers no law in the world would protect you; if you see fit to select men who cannot perform the duties imposed on them, you must take the consequences. As for the continual change of method, the only remedy is to call a public meeting and have everyone in your road district agree to some system of road improvement, grading, graveling or whatever it may be, and then carry into execution that plan of improvement, although each year may advance the road but little toward completion. Still it would be advanced in condition, and everything done would be of ultimate value. There should be a clause in the law, making the action of the people in the road district on such a point binding on the road overseers for at least ten years to come.

I do not believe that our highway laws, as they stand at present, should be changed materially; I do not believe any substitute could be devised as satisfactory in all respects as our present laws, yet there is one point, and a very important one, which they fail utterly to reach, and that is the proper construction of trunk roads. Our present laws are sufficient for the ordinary highways with a small amount of travel, and perhaps for the maintenance of any road if it were properly constructed. There are, however, important roads leading into nearly every town, which receive the travel and unite it from various branch roads, very much the same as the main river receives all the water from its tributaries.

The condition of this trunk road is a matter of interest to every person who travels over it; it is not a local affair, indeed the people who live directly along it may not use it, and consequently may not have as much interest in it as others living in a remote road district. The travel over it may be larger and consequently the need of repairs great, and the cost to maintain it probably large. Such conditions are not new, yet our law makes no provisions for such cases. This road, like any other, is maintained by a tax on the property immediately adjacent to it, and rarely is there any more labor per mile for this important road than for roads of no interest whatever except to the immediate residents. Illustrations of this may be drawn near any city, town or village in this State.

Our present law is unjust in that it makes no provision for distributing the burden of road building over the people who use the road, and it is faulty in that it provides no means of road repairing proportional to the traffic. I think the law should provide a method for the construction and improvement of trunk roads, independent, as far as may be necessary, of our present organization for road repairs. A very feasible plan would be to improve the roads by an organization similar to that authorized for the construction of public drains. The method of road improvement would then be outlined as follows: Resident tax payers who live along the trunk road or who travel over it,—the number can be specified per mile or township,—to unite in signing a petition addressed to the judge of probate of the county, if they live in different townships, asking for the appointment of a special road commissioner to improve that road. If the road lies entirely in one

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township the regular highway commissioner should be authorized to act. This special commissioner should engage an engineer, have a survey of the road in question made, and ascertain what improvements are necessary, with an estimate of the cost. This latter expense would rarely exceed fifteen dollars per mile. The work of construction could be apportioned through two or three years, if particularly heavy. After ascertaining the cost and the amount to be done per year, the commissioner should make the assessment exactly as highway work is assessed now, on all the property benefited and in proportion to the benefit received. In making this assessment the cities and the incorporated villages should not be neglected. They often receive as much benefit from the improvement of the highways as the people who live in the country, and it is but just and right that they should pay some of the expense incurred.

In conclusion, gentlemen, I cannot forbear urging some combination which, keeping within the limits of the law, shall enable you to complete some plan of road improvement. Whatever plan is adopted it will be found more satisfactory to attempt to carry into practice no more than can be completed in a single year. If you intend to put on gravel exercise care and judgment in preparing your foundation. Do not lay out more work than you can possibly finish. There can be nothing worse to travel over than an unfinished road, and as little time as possible should elapse between the commencement and finishing of a piece of road work. Again, I say that our road work needs above all things to be systematized. We want a plan for our improvements; we want to have an end clearly in view, and to accomplish that end we must make every day's work done in the district for years count for something. The task of graveling the roads is a huge one, yet I think that if a little is done every year, in the course of ten or twelve years you would find your whole district covered with gravel, whereas our ordinary year's work on the road gives us just about the same amount of permanent improvement as money spent at a circus. I believe a plan of work extending over a number of years could be laid out and carried into practice, by getting together the people in a road district, adopting some plan, and insisting that it be not altered until carried into effect.

COUNTRY ROADS.

BY J. K. PERRY.

Read at the Flint Institute, Jan. 30, '89.

That the present country road is out of date, all will admit, just what change should be made is hard to say; I would suggest, first, the township system should be done away and substituted with a county system, so as not to have highway overseers and forty pathmasters, elected every year by the rabble at the annual town meetings, to oversee so many little road districts.

There should be three road commissioners elected in every county for a term of at least five years, who should have absolute supervison of all roads in the county and then the work should be let on contract for a term of years. In this way we would have the work done by intelligent, responsible parties who would have teams and tools to do the work in a proper man-

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ner. But as we have the present system to work under, we will discuss it from that standpoint.

In the first place the poll-tax ought to be repealed or more efficient laws for the collection of the same should be enacted; for all pathmasters know that it is at present a dead letter, as it is impossible to collect it of those who have no property.

Some States have very stringent laws in reference to it. In Colorado the poll-tax is $4 and for non-payment a fine of $100 or 60 days in the county jail. Would it not be well to have the poll-tax $5 and some stringent laws for its collection?

THE ROAD BED.

It should be straight, of as little grade as possible, wide enough for teams to pass, of a gentle oval cross section, so that the water will run off at the sides, instead of lengthwise. There should also be an open ditch or gutter on each side so the water can run off; all stone and rubbish should be removed from one outside line of the road to the other. All weeds and grass should be kept mowed, all obnoxious weeds, such as burdock, Canada thistles, daisies, etc., should be rooted out. Culverts and bridges should be made of iron and stone; they will last longer and are just as cheap.

HOW TO MAKE A ROAD.

I make it with a road scraper; I would not discuss the making of one in any other way, any more than the harvesting a crop of wheat with the ancient sickle, because it is impracticable. I first stake out where I want the center of the road-bed, then plow two furrows six feet from the line of the stakes, turning the furrows toward the stakes and two furrows four feet from the stakes on the other side, then follow with the road scraper, scraping the first two furrows just to the line of the stakes, and the other two so they will partly lap over on the first two, avoiding making a ridge or cone; then plow two more furrows and scrape them just up to the others, and so on until the road-bed is as wide as desired, which should be at least 20 feet from one gutter to the other, then harrow thoroughly, picking up all stone and rubbish, and finish with the roller, leaving the gutters well cleaned out, so that no water will stand in them. As said before, have the road-bed a gentle oval, not too sidling.

If one wishes to make a complete road, gravel the clay parts, or, if gravel is not to be had, haul sand on the clay and clay on the sandy parts. One would be surprised what a good road can be made on a very sandy place by a layer of clay being put on it. Two men, a team and scraper, and one man, team and plow can easily grade one mile a day. I then run the scraper over the road a number of times in the spring to keep the ruts filled.

DISCUSSION ON ROADS.

The last two papers were presented at the Flint Institute, and between them, a paper on the same subject by Mr. A. L. Aldrich, which will be found printed on page 103 of the report of the Board of Agriculture for 1884, in which Mr. Aldrich contended strenuously that highway taxes, like other taxes, should be paid in money, and that all road work

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should be done under the direct supervision of one officer, and under contract; that there should be but one road district in a township, and that tile drainage should be a part of the process of all road drainage.

Mr. Hollenbeck: Foot passengers are neglected in all these discussions. School children have to walk to school and have rights to be considered, and provision should be made for them. In Canada they underdrain by a central tile with laterals from it every three or four rods.

Mr. Perry: The papers do not note the difficulty of obtaining stone in this region. One in four is too much crown for roads, and three-inch tile is too small for tile at the side of the road.

Dr. Miles: It is better to place the tile for underdraining the road bed at the sides, a little inside of the line of the open ditches rather than under the center of the road, for when they are so placed, if the surface of the road is hard enough to be impervious and sloped enough to throw the water to the sides it is always dry under the road bed itself, which will not be the case where the water has to go under the center of the road bed to find its outlet.

The advice to make the cross section of the road a gentle oval is wrong. The surface of the road should slope both ways gently and uniformly away from its center line to the side ditches.

Mr. Hollenbeck: All these papers propose to centralize power and increase taxation to make roads for posterity.

Mr. Rosencranz: I was raised near Ann Arbor and my father was pathmaster for years and I have worked roads for 35 years, and I know nothing of holiday road working. Roads can't be made in a day.

We have many hills that are sand on top, then quicksand and then blue clay, and whenever we grade down to near the clay level we get detestable roads. In such case how are they to be drained?

Prof. Carpenter: The only way is to build stone drains in the cut with ditches along the sides of the top of the cut.

As to paying tax in money or labor, the former has the arguments and the latter the facts. Our road work is well done, what there is of it. There is so little of it that even if it were applied as money it would amount to but little.

Pres. Billings: Our law allows towns to vote money tax and no town in the State has done it.

Dr. Wilson: Kersey street was a sandy soil but with a top surface that made a fair road originally. This was graded out and filled in with clay and then gravel, but not underdrained in the center, and it has been *very* bad ever since.

Pres. Willits: It strikes me that we often sacrifice more than we gain in sticking to the section lines for our roads. Prof. Carpenter has shown us that it may be actually as many rods over a hill as around it, while on the level road around the hill we may be able to haul two or three times the load that we could haul over it. Another consideration against the section line roads is, that it is always further from one point to another to go around a corner than to go directly, or, as with our section line roads, we have to say "across lots." The prime consideration in locating a road should be, where will it best serve the purposes of a highway? Not, where can it be placed so as to leave the squarest fields?

Mr. Pierce: I have noticed in the north woods, the method of getting out

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logs. The lumberman's profit or loss depends on the cost of hauling, and they find that it pays to have good road surfaces. Here we have clay roads, which need only grading and drainage, and sand roads which need no drainage, and have, two or three feet below the surface, a hard pan, 4 to 12 inches thick which, if dug up and used on the surface of the road, is as good as gravel. Put it on as thick as you can. It is composed of clay and gravel, and is of a red color; we strike it in digging post holes.

Mr. Thompson: My first principle in road making is to grade the hill tops down to the hard pan, and there leave it in place, unless it is absolutely necessary to grade lower.

Mr. Ladd: This hard pan makes a horribly muddy road in wet times.

Allen Dunn: I am more interested in knowing how to get men to work on the road instead of telling stories. One way is to let them work as much as may be on the road adjoining their own premises, where they feel personally interested in it. Don't do too much of the work near the path masters place, nor gather the men in too large gangs.

Mr. Thompson: That is just the reason why our road work amounts to little. Every man works over against his own house, and no general plan is pursued, and nothing accomplished. One year in my district I had but 32 days' work, and I put the whole of that on one end of the district, and so far as we were able to go, we made a good road. The next year we could take the next section, and so it would only take a few years to thoroughly make the whole road of the district.

Mr. Grant: Our State law is bad. Jackson county has had enough road work expended to macadamize every bit of road in it. I would make but about three districts in a town, and have all the work under the general supervision of one man, with authority to put all the work wherever it is most needed. As to macadamizing, it costs in Ohio, $3,000 per mile, and $100 per mile to care for it. They make it 18 inches thick, and thoroughly drained, and have a man going over the road every day.

THE PROBLEM OF THE PLAINS.

BY DR. R. C. KEDZIE.

Read at the Grayling Institute, Feb. 1, 1889.

In the northern portion of this State, scattered through 15 counties, are about 2,000,000 acres of light sandy soil, the principal timber being jack pine, with occasional groves of Norway pine. These lands have been called the pine barrens, jack pine lands etc. Wisconsin has about the same amount of the same kind of lands. The problem of converting these arid wastes into fruitful fields is an important one, from the large extent of territory, but the difficulties in the way of solving the problem, are numerous and perplexing. The pioneers on the plains had often asked advice and assistance, but no means were available for this purpose till the Hatch bill was passed. The money was not available until one year ago. The Board of Agriculture then determined to establish an experimental farm on the jack pine plains, and Grayling, Crawford county, was selected as an experiment station. The M. C. R. R. Co. donated 80 acres of land for an experiment farm. Contracts for clearing the land and prepar-

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ing for crops were let April, 1888, and one field was ready for seeding, May 31, and the other, July 5. The benefit of the early spring rains was thus lost by late seeding, and the dry weather of last summer was a serious drawback; but I now call your attention to the results as far as reached in one season's growth on the experiment farm on the pine barrens.

PREPARING THE SOIL.

The south field was cleared of trees and shrubs (except three Norway pines), grubbed and cleaned of everything that would withstand the plow. It was desirable to fit the field speedily for crops, and hence the grubbing was very complete. If I were clearing a farm for my own use, and in no hurry about cropping, I think I should only remove the oak grubs and leave the jack pine stumps to rot. Unless the oak grubs can be killed by "sprouting" it would be cheaper to remove them at the outset.

The land was plowed to the depth of seven inches. Many farmers get good results by plowing only two inches deep the first time, to kill the ferns and huckleberry bushes. This is done in the dry summer months, and acts as a summer fallow. In the fall or spring the land is plowed deep for crops. But I could not wait for a summer fallow, and wanted to seed the first season. Most of the wild plants were killed by this deep plowing, though a few brakes came up on this field.

I look with suspicion on summer fallows for these sands. Soil bareness leads to soil barrenness on light sands. To keep these lands covered with some form of vegetable growth is an important step in their improvement.

SUBDUING AND COMPACTING THE SOIL.

After plowing, the land was harrowed with a spring-tooth sulky harrow. The flat harrow was useless because it became choked and clogged with roots and trash. The harrow was followed by a spring-tooth horse-rake to gather the loose trash into windrows for burning. The horse-rake is the quickest and cheapest way to gather this refuse material, which is burned on the field and the ashes left for manure. The land was then rolled with a Johnson & Fields roller. The harrowing, raking, burning and rolling was repeated twice before the land was ready for seeding. The roller should be heavy, to compact the soil as much as possible.

SEEDING THE SOUTH FIELD.

The field was divided, north and south, into 21 plats nearly four rods wide, and a little more than 40 rods long, containing nearly one acre each. These were seeded on the last day of May and first day of June, the seeding being done for the most part with a Disc roller drill, but the light and chaffy grass seeds were sown by hand and harrowed in. After seeding, the whole field was again rolled.

THE NORTH FIELD.

The field of 20 acres at the north end of the farm was cleared and prepared for seeding in all respects like the south field. It was ready for seeding July 5th. A square of one-quarter of an acre, in the northwest corner,

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was sown to New Zealand spinach. The plats run east and west. The north plat was sown to vetch; the next to spurry; then June clover with seven-leaved turnips; then June clover and white turnips: then field peas; then spring rye; and lastly alfalfa or lucerne. The spinach and west half of the vetch and spurry plats had a dose of marl; the rest of the field was sown with plaster at the rate of 200 pounds to the acre.

THE VILLAGE FIELD.

The ground on the experimental farm being all "new breaking," it was thought desirable to make parallel experiments with land which had been under cultivation and more thoroughly subdued. A field of eight acres in the outskirts of the village was rented of Mr. Brink. The field had been in cultivation for three or four years, and seemed fairly subdued. This was plowed and harrowed, seeded on the 17th of May, rolled and plastered. Three acres were assigned to Prof. Beal for experiments in grasses and forestry. An acre in the southeast corner was sown to vetch and spurry, and a small patch to New Zealand spinach and seven-leaved turnip. These were sown June 2d.

THE PROBLEM STATED.

In carrying out any experiment, it is necessary to have a clear idea of the points to be proved and the questions involved. The matter for present consideration is, how to bring these lands into profitable cultivation by such methods of tillage, and the use of such manurial materials as are within the reach of every farmer of moderate means. It does not include the use of stable manure, for the reason that this cannot, at present, be obtained in sufficient quantity to supply the needs of the plains. No one need doubt the capacity of these sandy soils to produce crops with plenty of stable manure at hand. The first question is, how to raise the crops on these lands to furnish a supply of stable manure.

The present inquiry does not take account of possible results, by the use of commercial fertilizers. There is little question, that with the free use of commercial manures affording abundant supplies of potash, ammonia, phosphoric acid, etc., large crops can be raised on these plains. A successful market gardener near New York City, once said, "All I ask of the soil is to hold the plant while I feed it." That may do for market gardening near a large city, but it will not do for general farming in central Michigan. The lavish expenditure of money for the production of crops without consideration of the cost, is as worthless as it is extravagant. These commercial fertilizers are beyond the means of the pioneer and homesteader, and hence outside the present inquiry.

The problem briefly stated is this: With a light sandy soil of very porous quality, in a northern climate subject to late frosts in spring and early frosts in autumn, and liable to midsummer drought, with no fertilizers except marl, salt and plaster, can any methods of tillage or kinds of crops bring these plains into profitable cultivation for ordinary farming, stock raising or fruit production? With what the soil now contains, what plants may accumulate from the air and rain, and return to the soil when plowed under for green manure, and with the cheap mineral manures so abundant in this State, can we bring these sandy soils into profitable cultivation?

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I do not include wood ashes in this list of manures because they cannot be obtained in sufficient quantity in this section. Valuable if obtainable.

THE WEATHER.

Judging from the usual remarks on the weather one would conclude that as a general rule every season is "exceptional." But 1888 seems to get a nearly unanimous vote as to its exceptional quality. The people of Crawford county claim that the past summer was exceptional both as to rainfall and temperature. Unfortunately no meteorological records have been kept in this county. The summer in the central and southern portions of the State has been very dry. At the Agricultural College the rainfall for six months, April to September, was only 13.48 inches, while the average for the same months during 25 years was 18.54 inches, a deficiency of 5.06 inches. The deficiency for four months, June to September, was 4.39 inches, or one-third the average rainfall for those months. From all I can learn the drought was more severe in Crawford than in Ingham county. The temperature also was abnormal. The minimum self-registering thermometer at the College marked a temperature at or below frost point on May 1st, 15th and 16th, and again September 13th, 14th and 27th. This thermometer was suspended four feet above ground and under cover. The temperature at ground level and under the open sky would be 8 to 10 degrees lower. Taking this as a starting point we find that frost point was reached in open grounds on May 1st, 2d, 5th, and every night from 12th to 20th, and on 31st; on 2d and 3d of June, on 22d, 27th and 31st of August, and on 4th, 5th, 12th, 13th, 14th, 27th, 28th and 29th of September. This list shows six general and eighteen white frosts at Agricultural College between the 1st of May and 30th of September. Grayling is 130 miles north of the College, and would show, if not a greater number, an increased severity of frosts. Plants that will endure such drought and cold as were seen in Grayling last season may be considered weather proof for Michigan climate.

THE CONSERVATION OF SOIL MOISTURE.

One prime condition of vegetable growth, and one, in absence of which, all other conditions of fertility are vain, is a supply of water in the soil. Over the rainfall we have no control. Man may make the soil, but God makes the weather. It is as true today as in days of old: "He sendeth His rain on the just and on the unjust." If we cannot command the rain, it is our problem to husband the rain that falls and hold it for time of need and to draw upon the sub-soil water as occasion requires. To this end we may increase the retentive power of the soil for moisture, lessen its evaporation, and increase the capillary power of the soil; and in all these ways we may render an increased amount of moisture in the soil available for the use of crops.

The presence of a certain amount of vegetable matter in light soils increases their power to take up water, and it lessens its loss by evaporation. An increase of vegetable mould in the soil of the plains will greatly improve its quality. The annual fires that burn up the surface accumulation of leaves and vegetable matter are among the worst foes of the plains.

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The water line at Grayling is about 15 feet below the surface. If we can draw upon this sub-soil supply of water for our crops we may do much to mitigate the drought and promote growth. Our hold upon this water is by means of the capillary power of the soil. The means by which we may modify the capillary power of the soil deserves attention. A lamp wick which draws up oil, to feed the flame, by capillary action, must not be too tight or too loose in the socket to act satisfactorily. Capillary action in the soil has similar limitations, and a certain porosity in the soil will secure the best capillary action. By compressing a loose and porous soil we increase its capillary power. This is one great benefit from the use of the roller on these soils. This increase of capillary action by the use of the roller is not the only advantage on these sands. A compact seed bed is a necessary condition for vegetable growth. If anyone will examine the wagon roads running through these plains—the old, wandering cross-lots roads through the woods—and will observe the heavy sward of grass where the soil has been beaten down and compressed by the passing wheels and the feet of the teams, he will see evidence of the benefit of compacting this soil. The roller will do as much for these lands as the plow. But the roller needs to be a heavy one to give the best results. I made a mistake in getting too light a roller.

In many soils loss of water by evaporation is checked by keeping the surface so thoroughly stirred as to prevent surface capillary action, and thus a non-conducting surface is interposed between the drying air and the moist soil beneath, and in this way the loss of soil-water by evaporation is diminished. "Proper cultivation is irrigation," says Dr. Sturtevant. To a limited degree this is true of most soils. Is it true of these sands? Light cultivation of hoed crops will mitigate drought; what will be the effect of lightly harrowing meadows and sown crops at the beginning of a drought, and at intervals during its continuance?

The relation of these sands to capillary water, surface evaporation, etc., will be made a special study the coming season.

a. Plowed.	1st. Surface soil,
b. Plowed and harrowed.	1 to 8 inches.
c. Rolled.	
d. Sodded.	2d. Subsoil,
e. Lightly stirred or raked after rolling.	8 to 16 inches.

MANURES EMPLOYED.

Let me call your attention to the manures used on these lands.

Marl is found in large quantities in swamps and small lakes in these northern counties, and the first cost of the material is nothing. The only question is the expense of removal from the marl beds, and of spreading it on the land. The benefit of marling is immediate and lasting, and there is little danger of injury from its free application.

The good effects of applying marl on the expermental fields were evident. On the south field the marl was placed in a large pile before the land was ready for marling, and when it was removed to dress the field, a heavy marling was left where the marl heap was placed. Here a heavy growth of grass was found making an island of green, visible at some distance.

The small lake on the school section, near the experimental farm, contains thousands of tons of marl. It has the following composition:

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Carbonate of lime, Carbonate of magnesia,	95
Phosphate of lime	1
Organic matter	3
Sand and insoluble materials	1
	100

This shows the value of this marl for use on the sandy soil.

The objection to marl is the cost of getting it out of the lake and into a condition for distributing on the land. It is taken out of the water with a long handled scoop, loaded into a boat, carried to the shore and placed on a platform to dry, before it is carted to the field. It is thus handled three times before reaching the field. The best marl has so little cohesion that when it is stirred up with water it forms a creamy semi-liquid mass which is very difficult to handle with scoop and shovel. The marl used in these experiments costs $3.50 a cubic yard, delivered on the field, and the men only make fair wages. The marl is not worth $3.50 a cubic yard for manure. Some cheaper means must be contrived to land the marl. The fact that the marl stirred up in water becomes a semi-fluid mass, suggests a quicker and cheaper way of handling it. A large rotary or chain pump fastened to the side of a scow, the lower end slipping down into the marl, the pump geared to a tread-mill horse power on the scow, could raise the pulpy marl and water to a gutter to carry them to the land, where they could be received in a bed made with sides of board and a bottom of the sandy soil. The water would soon leach away and leave the marl in fit condition for carting. I believe a chain pump run by hand would land more marl in a day, than a man could land by scoop and scow, in the old way. I throw out the hint and leave you practical men to fix the details for cheaper marl.

Plaster.—The benefit from the use of plaster on most of the crops was marked. Comparing the benefit with the cost, I think it was the cheapest manure used in these experiments; yet, the cost is excessive in consequence of high price for freight. To pay $10 a ton for plaster that only costs $2.50 in Grand Rapids, looks as if somebody was making money faster than the farmer. You must find some cheaper way to transport plaster. Perhaps the immense deposits of plaster at Alabaster bay may be brought into use for this section. The plains will yet consume a large amount of plaster.

Salt.—In the dry season just passed, I could see no benefit from the use of common salt—further trial needed.

RESULTS IN GROWING PLANTS.

We turn our attention to the results attained in growing plants on the plains under these discouraging conditions of climate. You will note the prominence that is given to this subject in the year's work. A condition of first importance is to know what plants will succeed under the peculiar conditions of soil and climate on these plains. The direct effort to raise ordinary crops at this stage of experimenting seemed to be of secondary importance. A large number of seeds have been sown, not with the expectation that all would make a successful growth, but to find what would grow, and how complete development each one would reach. It is worth much to

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know what plants would fail, and the cause of their failure; it is worth more to know what plants will succeed.

PLANTS THAT FAILED.

Many plants usually of great value for building up soil fertility by green manuring were failures on the experimental farm:

I—Because of Inability to Withstand Frost.

(*a.*) First in this class I place the "cow pea" of the south. This is a rank grower, and accumulates a large amount of vegetable matter, rich in nitrogen, and of great value as a soil renovator; but it is so easily cut by the frost that it more resembles the bean than the pea. The frost in June destroyed nearly every plant.

(*b.*) The New Zealand spinach has most wonderful power of withstanding the drought. Some plants in flower pots in my study were purposely left without water till the soil was dry and the plants were yellow and apparently dead, yet a good watering revived them, and they grew vigorously. This was repeated with the same plants, and with the same result; but the plant was nearly as tender to frost as a cucumber, and when frozen it withered and shriveled into an insignificant mass.

(*c.*) The Martynia is less vigorous in growth than the New Zealand spinach, and nearly as tender to frosts, and of no value as a manurial plant on the plains.

(*d.*) The yellow branching sorghum fell before the frost of June. Probably all the sorghums are too tender for this climate.

II—Failures from drought in 1888.

(*a.*) The grasses as a class failed. Timothy, Kentucky blue grass, orchard grass, meadow foxtail and meadow fescue were all failures last season. For the most part they did not come up at all. The same is true of Bokhara clover and triticum repens or quack grass. Perhaps the seed was not good. Mustard was of no value though it made a straggling growth.

III—Partial Success.

Field peas, alsike clover and spring rye made a moderate but unsatisfactory growth. I was disappointed with the results with peas and rye from which I had expected striking results. The buckwheat was more successful, yet failed to satisfy. Tall fescue made some show, and may yet prove valuable. The perennial rye grass gave good promise and is the only grass that gave me encouragement. The seven-topped turnip was a disappointment. It usually develops a large mass of leaves, with little or no bulb, like other turnips. The tops were not equal to those of the white turnip, and did not afford so much shade to other plants.

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PLANTS THAT SUCCEEDED.

After this list of failures and partial successes but little removed from failure, it is pleasant to speak of the plants that did succeed, and that give promise of usefulness even under the severe climatic conditions of last season.

A wag living in a place distinguished for breachy stock said they needed a fence "horse-high, bull-strong and pig-tight." Plants of similar robustness of constitution seemed to be required for these plains. I name these plants in the order of their success: Winter vetch, spurry, mammoth clover, alfalfa, June clover, Hungarian grass, white turnips, lupins, white clover, millet and perennial rye grass.

You are familiar with many of these plants and I need not speak of their value as forage plants. But the vetch, spurry and alfalfa are not so familiar, and I will call your attention to their value by comparing their composition with that of red clover cut in blossom. The figures for vetch and spurry are from analyses of the plants grown on the experimental farm, and you will note how they compare with the red clover in best condition for hay.

COMPOSITION AND FEEDING VALUE.

Name of Plant.*	Water.	Organic matter.	Ash.	Albuminoids.	Carbhydrates.	Crude fibre.	Fat.
Red Clover	16.70	77.10	6.20	13.40	29.90	35.80	3.20
Winter Vetch	7.30	83.76	8.94	10.85	36.94	32.87	3.10
Spurry	7.32	83.18	9.50	10.26	43.97	25.05	3.90
Alfalfa	16.70	76.90	6.40	14.40	22.50	40.00	2.50
Timothy	14.30	81.20	4.50	9.70	48.80	22.70	3.00

* All plants cut in blossom.

You will observe that the vetch and spurry resemble clover in feeding quality, and are superior to Timothy hay.

To give some idea of the amount and rapidity of growth, plants taken from these fields, of two and three months growth, were shown at the State Fair in Jackson. One very conscientious ex-member of the legislature from Lenawee county, after carefully looking over these plants, said to me confidentially: "Doctor, you need not make such a fuss over these plants. I can raise just as good crops on my prairie land in Lenawee county!"

The seeds for these experiments I obtained from D. M. Ferry & Co., of Detroit, A. Dickinson, of Chicago, J. M. Thorburn & Co., of New York, and some were imported from Paris. I also furnished Prof. Beal a supply for his experimental stations in Oscoda, Harrison and Walton. I am importing other kinds, and looking for any plant that promises to be of service in this soil and climate, believing this question to be of first importance.

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THE PROSPECT.

It is early in time to predict the outlook for farming on the plains. Perhaps in the immediate future the best results will be reached by stock farming, sheep and wool, dairying and stock raising. In other words, to accumulate in the soil as much of the products of air and soil as possible, only selling off the high-priced products, wool, butter, beef. When these lands are brought to such a state that they will produce enough forage to winter our stock, with summer folding on the fields, the road to successful farming on the plains is open.

Prest. Willits: Will Dr. Kedzie tell us something about the qualities of alfalfa?

Dr. Kedzie: The roots of alfalfa are peculiarly long and branching, and the plant itself stools very freely. In analysis, it is a little better for feed than red clover.

Capt. Barker: I have grown one-sixteenth acre of alfalfa for eight years, and it has stood the climate beautifully, and this summer, in same field with clover, Timothy, red-top, etc., the grasses were all a perfect failure, and the alfalfa was knee high, and green and luxuriant.

Prest. Willits: Alfalfa is a perennial that grows on for 15 years, and then is as good as ever. In California, they say that it gets roots 15 feet long. If so, it can keep itself in water.

Capt. Barker: My alfalfa is mixed with other grasses, and was not killed by plowing.

Mr. Steckert: I have grown it elsewhere, and it was cut three or four times per year, but was not esteemed very highly as hay.

Dr. Kedzie: Our seed came from Thorburn, and cost nine dollars per hundred weight, and is a little smaller than clover seed.

Mr. Gridley: In Colorado, it is six dollars per bushel.

Mr. Steckert: In importing seed from Germany, the way charges, besides original cost, were eight dollars per bushel.

Dr. Kedzie: Sow about as much per acre as of clover. Sow spurry much lighter per acre than clover. It is about six dollars per hundred weight. It seeds itself, and becomes a weed on rich or heavy soils. It ripened its seed here in three months, last summer. It is not perennial, but is annual. I wish to recall your attention to the winter vetch, which to my mind is the most promising of all forage plants. It is equal to clover for forage or green manure. It is a biennial, as is clover.

Dr. Niles: Will fall frosts hurt any of these plants?

Dr. Kedzie: They will hurt millet, but not hungarian. Spurry and vetch will be somewhat hurt by them.

Dr. Palmer: On the experimental plats, spurry and vetch stood the best of any of the plants named—better than either of the clovers, until the first hard freeze.

Capt. Barker: A farmer in Cheboygan county received some spurry and vetch seed from the U. S. Department of Agriculture, and sowed it in his front yard, and they both stood the winter as well as clover.

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ORIGIN OF THE PINE STUMP FARM.

BY HON. WM. LADNER.

Read at Big Rapids, Feb. 8, 1889.

Years ago the lumberman visited this region, and realized his thousands or millions of dollars from the lumber, but left the land almost valueless, in many instances; not even worth the taxes; so that they could be purchased for a nominal sum.

Now comes a man with a small family, and settles, with a view of making a home. He builds a cabin, with only his noble wife to help him, and as they have no team, rolls up the old logs, and at night burns them, picking up the rubbish by the light of the log heaps. He hurriedly fixes a small piece of ground and plants a few potatoes. During all this time the family has to be kept, and are constantly wearing out their small and scanty supply of clothing, so this farmer looks around and beholds his farm blooming like a potato patch, for now he is a farmer.

His small supply of provisions is about gone, so in the morning he says good bye to his little group and sallies out to the lumber camp or shingle mill in search of employment, of which there is always enough. A little money earned, he returns to his home. On rising the hill over-looking his cabin, what meets his gaze? The potatoes are nicely up; not a weed to be seen. His faithful wife, with the help of her little ones, has pulled the last weed. They have also stripped the bark from at least an acre of stumps—this being their supply of fuel for the summer—the farmer not having the time to leave a supply of wood. At home he feels as never before—under his own roof with his winter potatoes in sight, but not a pig or a cow. Think of this for a home! It is noble. He is an independent farmer.

Haying and harvest time is at hand. He again goes in quest of employment, with his red bandana in hand, in which is a change of wardrobe. Being absent about a month, he has accumulated a small sum, which looks big to him, and again he makes his way towards his home. On arriving he finds everything lovely. It has been a busy summer at home. The wife, with the children, has picked huckleberries, enough for their own use and some to spare, while the black caps and red raspberries look good enough for a king—and they have plenty of them. All this time the potatoes are growing, and a few more old pine stumps are stripped of their bark. The time now is fast approaching when winter, with its cold and piercing winds, sweeps down the old slashing—when it is necessary to provide for the little family, before the farmer leaves for the lumber camp, which he is compelled to do. Some clothing of a cheap kind, shoes and provisions exhausts the pine stump farmer's supply of cash.

Five months and perhaps six have passed, and he again makes his way homeward. He is welcomed by his faithful wife, who has cared for their little ones through this long and tedious winter.

One year gone, and not one pine stump less to contend with. But a farmer must be diligent, faithful and full of grit in order to succeed on a pine stump farm.

Five and perhaps ten years of the same routine have been gone through with. The pine stump farmer has not been idle, he has accumulated some

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wealth, he has a cow, or perhaps two, and he owns a pair of steers. During all this time, there has a village, or perhaps a city like Big Rapids, sprung up within reach of him. Now he is a very independent pine stump farmer. He can cut two cords of pine wood today, put it on his wagon or sleigh and bring it to town and next day stand on the corner of the street, where there is a market, and offer his wood for one dollar per cord, and just about night a person comes along and offers him ninety cents. I guess he takes it. That is not so bad, he expects to sell as soon as he gets to town, so he stables his oxen in the street, goes without his dinner, and is nothing out.

Ten years gone by. Not one solitary pine stump less. I never knew one to rot or burn up unless it was pulled and well piled. There is one redeeming feature of our stump farm. The soil is usually good, and the surface level. During the first five or ten years our stump farms, as a rule, have not had the attention or care they need.

They have been cropped and somewhat run out. It is a hard and slow job for a man of small means to pull and take care of the stumps, although I am very glad to say there are a good many stump machines in this and adjoining counties. I would not advise a man, after the struggle of the past, to mortgage his farm for a machine, nor sell his last cow, but I would advise anyone to get a stump machine as soon as possible.

One hardly realizes the loss annually among the stumps until he has a field cleared. In a crop of wheat, oats or rye we do not notice the space occupied by the stump so much; but potatoes yield small and few near the stump, and we can see very plainly the loss in a corn crop. For instance, in cutting corn into shocks of seven hills square, it yields a bushel or more of ears per shock, in good ground, but when you come in contact with a stump, only a few small stalks and a few nubbins are the contents of that shock. In using a two-shovel cultivator we never break one between stumps but always on an unseen root of a stump. So you can plainly see that it is quite a loss to farm among pine stumps. In two corn crops in succession you lose at least one bushel of corn per stump, which is at least twenty-five cents, that being about what it costs to pull a stump. After they are pulled they are worth all it costs to move them, for fencing purposes. This does not include the inconvenience nor loss of time in preparing a field for a crop among stumps. In the first place a man can plow from one-third to one-half more if the stumps are out, for the roots extend sometimes as much as twenty feet on either side, varying in depth and always obstructing the plow and harrow. If the field was clear of stumps the farmer could use a wheel cultivator that would cultivate one row at a time, using a team with a boy. A crop of wheat or oats must be cradled, as we cannot use a harvester or self-binder to advantage. There is quite a contrast between the pine stump farmer of ten years ago, and the pine stump farmer after his stumps are pulled. The former digging among stumps with his mattock and brush hook, plowing at a slow rate, with his steers sweating and fretting and tired, and a poor crop. The latter can ride his wheel plow, use a wheel harrow or cultivator and harvest his grain with a self-binder. He can attend State institutes and farmers' clubs, and discuss the advantage of fertilizers, etc. But he must never have an excuse for not sowing clover seed, as that is our only salvation.

I feel very much encouraged with the amount of stump fences that I have seen within the last year or two. Ten years from this time there will be thousands of acres of this stump land rid of the stumps, and the same put

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into fences which will last a life-time, and then the pine stump farmer can take as much comfort as any other farmer.

Mr. Martin: Which is cheaper, dynamite or a machine for stumping?

Mr. Ladner: I would not use dynamite, as it splits the stump and renders it useless for fencing.

Mr. Burnett: Twenty-five cents won't pull the stumps, and dynamite is dangerous. I own a Chamberlain machine, and have two acres of pine stumps, and it takes a ten acre lot to hold a stump after it is pulled. Cleaning is a much worse job than pulling. I can pull for ten cents, but after pulling it is impossible to get rid of the stumps. They are vile fences, serving as nests for weeds and brush which draws the strength of the soil for 12 to 20 feet on each side.

Mr. Ladner: I let a job of pulling and cleaning at 25 cents and the man made money at it, and when pulled, I would not let any one have the stumps for the taking. Stump fences can be kept clean of weeds.

Mr. Lincoln: The cost of pulling depends on the soil and age of the stumps. In heavy June grass pasture it is worth two or three times as much to clean them as in sandy land, and green stumps are worse to clean than those that have been dead for ten years.

Mr. Burnett: I can't raise good crops where the stumps came from.

Mr. Smith: As to the looks of stump fences, it is a matter of taste. I would never buy a farm with the best stump fence ever made. They last forever and a day it is true, but let Canada thistles get in, and how can you contend against it?

Dynamite costs from 20 to 50 cents per pound, and a stump two to five feet in diameter will need one to two pounds, and even that is not sure to do thorough work. The question is, will it pay at present prices to make pine stump land farms at 50 cents per acre for the land and 25 cents per stump for pulling, a total of about $12.50 per acre on the average. These stumps will ultimately be worth pulling to make tar and turpentine of.

Mr. Ladner: It is with many of our people not a question of choice, but of necessity. They are here, and they have got to get rid of the stumps. They have got to go, and we who live here and have to make our living out of these lands have got to dispose of them in order to live.

Mr. Burnett: A relative of mine left a position as a laborer in southern Michigan and came here and took a pine stump farm, and he is now independent at home and earning his living, and is not dogged around by others.

Mr. Blair: In Newaygo county we have a man on a stump farm who is winning wealth. He now has a self-binder, when at first he was in a wilderness of stumps. Their stump fences are straight as a line. There is no use in running away from Michigan obstacles to seek betterment in Dakota blizzards. The better way is to make the obstacles do the moving and stay ourselves.

OUR SOILS.

BY HON. L. D. WATKINS.

Read at the Brooklyn Institute, Feb. 15, 1889.

Geologically speaking, our soil was formed in its present state by the glacial drift. This drift soil was formed, before our peninsula was clothed

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with vegetation, by the most wonderful disturbances and conflicts of the elements.

Over the solid rock-crusts of the earth, swept from the northward vast torrents of mingled rock, water and mud, covered with fleets of icebergs bearing loads of rock and earth at phantom speed, until all became one solid mass—the soil as we now have it—an orderless, rubbishy mixture of all the minerals and rock of the earth's surface, suggesting that this must have been the great dumping-ground of the soil building era.

Here, side by side, will be found boulders of the Trenton, Niagara and Hamilton groups with their characteristic fossils, sandrock from the Waverly group, boulders of greenstone and granite, conglomerates, and many others, mingled with fossils of land and sea, with broken pieces of coal, iron and copper—in fact, a commingled mass of the wreckage of a world.

All these and many more may be found on any farm in this county. They may be so finely broken up that their structure and name can be determined only under the glass, still every particle of earthy dust is a perfect rock. Thus we have a soil made up of fragments of all the rock formations and minerals of a prehistoric world.

All these various substances can be reduced to three, viz.: Sand, lime and clay. These form more than ninety per cent of our soil; all other forms of rock, or soil, are their chemical or mechanical combinations.

It is extremely difficult to give the exact composition of our soils. In fact, in a drift soil like ours, a single field will often contain all the intermediate soils from heavy clay to light sand, with sections of marsh or peat land. This latter has its origin in the slow decomposition of semi-aquatic plants, and is largely made up of humus. In the natural state it is not valuable in general agriculture, but yields readily to intelligent treatment, and is destined to become our most valuable land. A simple application of stable manure, and grazing out the original vegetation—sedge—will, if not drained too much, make it very valuable land.

Thus from the nature and origin of our soils, made up as they are of all needed chemical and mineral combinations, it is certain that, with the exception of our marsh lands, they contain all the inorganic elements needed for the highest state of fertility. We shall need, in order to make our soils most productive, an abundance of those substances which form the chief part of all living organisms, and constitute the principal part of their food. These are carbon, hydrogen and oxygen, and a small amount of nitrogen. These compose the dark coloring of our soils, forming a substance called humus, or humic acid. This substance is the decomposed remains of all animal and vegetable life, since the present formation of the earth's surface, and is of the greatest importance to the farmer.

To these four principal organic foods of plants, viz.: Oxygen, hydrogen, carbon and nitrogen, I will add the inorganic foods as follows: Sulphur, phosphorus, chlorine, iodine, potassium, sodium, calcium, magnesium, aluminum, silicon, iron and manganese. All of these latter in such abundance in our soil, as to give us no uneasiness for the future.

But the organic and most essential parts of plant food are being constantly exhausted by cropping, evaporation and washing, until some of our farms begin to show poverty as well as their owners. How, then, shall we supply and keep up the fertility of our soils, and at the same time, add to the owner's income? I shall answer with the greatest confidence: grow stock;

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grow more stock, and less wheat; grow *good* stock only; grow grass—corn, oats and barley are grasses—grass is the base of successful agriculture. "No grass, no cattle; no cattle, no manure; no manure, no crops." "Grass is only another name for beef, mutton, bread, and clothing." These are old proverbs.

Grow all kinds of stock:—sheep, cattle, horses, hogs; feed them well; and they will feed your hungry acres well.

I shall say nothing of the fertilizers so freely advertised. They are well enough for lands that are non-productive from constant cropping or natural infertility.

Do not believe that when you spread a load of stable manure on your land that the only benefit derived is from the carbon, oxygen, and hydrogen it contains, less the loss by washing and evaporation.

We do believe that in the chemical and mechanical decomposition of this manure, by and on the soil, that large amounts of nitrogen and other plant food are taken from the air, and in nature's perfect laboratory, made available for the food of plants. We know that the inorganic soil supplies us with all our mineral needs; that three-fourths of our air is nitrogen; that one-half of all substance is oxygen; that one-ninth of water is hydrogen; that from 40 to 50 per cent of all living things, and of their decayed remains, is carbon. Thus we find ourselves in a vast store-house, filled to overflowing with every element of the highest fertility, needing only the key of knowledge to unlock its boundless treasures.

Let me prophesy that in the near future this fair land will be owned by him who is alone worthy of the trust and the responsibility—the careful, painstaking *student* of agriculture.

THE LIMIT OF PROFITABLE INCREASE OF YIELD.

BY EUGENE DAVENPORT.

Read before the Albion Farmers' Institute, 1889.

It is a matter of common experience that our heaviest yields bring the greatest profits, and observation shows that those farmers who raise the largest crops are the most prosperous. He that is niggardly with his farm or his business must be content with low yields and small profits. He that steals from his soil the accumulated wealth of centuries and never repays the loss, will be rewarded by steadily diminishing yields, though at first profitable, the inevitable end is poverty, for nature, as well as man, abhors a thief.

But while the soil responds liberally to generous treatment, by way of culture and fertilizers, it is evident that there is, for every crop, an upper limit of yield beyond which it is impossible to reach, and that this limit is attained only with enormous expense for fertilizer and labor, and is not profitable. The highest known yield of wheat was 90 bushels per acre. While that particular crop might have been profitable, an effort to secure it every year would not only fail but would result in financial loss.

The highest, as well as the lowest yields, are not remunerative, and somewhere between lies the profit. The question is not: "How large crops *can* we raise?" but rather: "How large crops can we *afford* to raise?" Do they increase in direct proportion to fertilizer applied? Where is the line of

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greatest profit? Are larger yields a remedy for lower prices? These are live questions in agricultural science and in farming practice.

Fortunately the experiments of Lawes and Gilbert with different fertilizers in different amounts, upon wheat, in permanent plats, were continued for sufficient time to furnish reliable facts upon the action of different amounts of the same manure. These experiments have been in progress for more than forty years, but in the later years some of the heaviest applications were discontinued, and this paper will consider only the first twenty years.

These experimenters soon learned that upon wheat mineral manures alone had little effect, and that some form of combined nitrogen is the active agent in increasing the yield. Ammonia salts were employed for that purpose and in greatly different amounts upon different plats. Wheat was sown each year upon each plat, and the treatment of a plat once begun was unchanged throughout the experiment. For the present purpose but a few of their many plats will be considered, and the numbers employed are here used only for convenience of reference. These plats are the *only* ones so treated, and these particular ones are chosen as being the only ones illustrative of the principle under consideration. Hence the conclusions drawn are fairly taken and are in no sense "sought for."

These plats were annually treated for twenty consecutive years, as shown in the following table, which gives the average yield of each plat, omitting the first eight years, that the differences may be due solely to treatment. Hence the figures are for twelve seasons after eight years' preliminary treatment.

Table Compiled from Wheat Experiments of Lawes and Gilbert.

Plat number....	1	2	3	4	5	6
Number of years through which experiment continued.....	20	12	12	12	12	12
Fertilizer.....	None.	Mixed mineral manures alone.	Mixed mineral manures and 200 lbs. ammonia salts.	Mixed mineral manures and 400 lbs. ammonia salts.	Mixed mineral manures and 600 lbs. ammonia salts.	Mixed mineral manures and 800 lbs. ammonia salts.
Average yield in bushels per acre	15¼	18¾	28¾	36¾	38	38¼
Increase due to each successive addition of fertilizer.....		2¾	10	8	1¼	¼

The above results are represented graphically in the following diagram by the line marked C D, while the line A B shows the results of the same experiment for forty years, that is twenty years longer. This lower line and the yields for the forty years are given only for comparison. In the diagram each vertical space represents one bushel average annual yield, and attention is directed to the *upper line*—the yields for twenty years.

Diagram No. 1, showing yield per acre of different plats:

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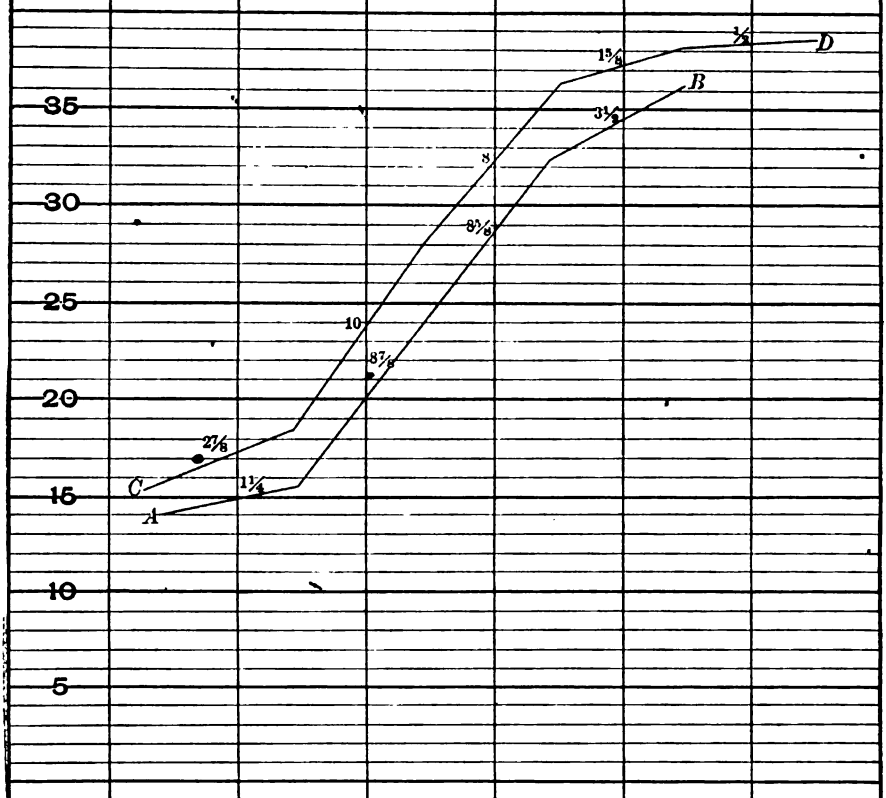

Kind of Fertilizer used.	No Manure	Mixed Mineral Manure alone.	Mixed Mineral and 200 lbs. Ammonia Salts.	Mixed Mineral and 400 lbs. Ammonia Salts.	Mixed Mineral and 600 lbs. Ammonia Salts.	Mixed Mineral and 800 lbs. Ammonia Salts.
Average yield.	20 Years 15½ Bus.	12 Years 18⅜ Bus.	12 Years 23⅜ Bus.	12 Years 36⅜ Bus.	12 Years 38 Bus.	12 Years 38½ Bus.
	40 Years 14 Bus.	32 Years 15¼ Bus.	32 Years 24⅛ Bus.	32 Years 32¾ Bus.	32 Years 36¼ Bus.	———

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These are the largest known yields ever attained for so long a period by any system of farming, and moreover appear to be the limit of yield for that soil and locality, as no other combination produced equal results.

Note, first, the comparative uselessness (for wheat) of mineral manures alone; second, that successive additions of 200 pounds each of the effective manure (ammonia salts) gave for 12 years a descending scale of increase of ten, eight, one and five-eighths and one-half bushels; and for thirty-two years, of eight and seven-eighths, eight and five-eighths and three and one-half bushels; third, that these differences were less marked for the entire period, as shown by the lower line, but that the same general principle held, as through the first 12 years, of a decreasing effect upon the yield of each successive addition of manure.

(The fourth 200 pounds, from its slight influence, was discontinued for the last twenty years.)

Clearly, then, successive additions of fertilizers are not answered by corresponding additions to yield, although through a liberal range the difference is inconsiderable.

Much speculation has been indulged in as to comparative effects of varying amounts of fertilizer, which it seems these results should help to set at rest. The well known fact that residues of ammonia salts accumulate but slightly in the soil, and of nitrates not at all, taken in connection with this law of action of fertilizers, would teach the use of commercial fertilizers in only moderate amounts.

Mr. J. Valentine of England, the great champion of commercial fertilizer, places the profitable limit at 18s ($4.37) per acre.

A correlative truth to which I desire to call attention, and on which some erroneous views are held, is this: *The limit of profitable increase, and the line of greatest profit fluctuate with the market price,* an increased yield alone is not the remedy for low prices.

This record of twenty years proves clearly that the last bushels of increase are secured at greater cost that the first, and that excessive yields are produced only at inordinate expense, and waste of fertilizer. This being true the *highest* yields mentioned could have been produced at a profit only when prices ruled exceedingly high.

The last one-half bushel of increase was secured at the same expense of fertilizer (200 lbs.), as was the first ten bushels, and at present prices of fertilizer this last half bushel cost $7.50—enough to absorb the profit from many, if not all below it. Whatever the prices of wheat or of manure, the facts seem to be that the last one-half bushel of possible increase costs as much as did the first ten bushels; that for high yields the last bushels are the most costly, and that yields that are profitable with wheat at $2.00 per bushel are only secured at a loss when it sinks to $1.00 per bushel.

The following diagram illustrates this relation between cost and income applied to the yields represented by the upper line of diagram No. 1; that is, the average yields for the past twelve years of the first twenty years of Lawes and Gilbert's experiment.

Assuming the cost of an acre of unmanured wheat to be $10—nearly the reported cost in Michigan—and adding to this the market price of the fertilizer applied gives the line of cost, shown in the diagram by the dotted line, K M. The other lines show the income per acre of the several plats at different prices per bushel.

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Where the line of cost is above the line of income the crop is raised at a loss, and in the cases where the two lines cross, the point of intersection shows the point where profit ends and loss begins.

Thus at $1.00 per bushel this point is reached at a yield of about 38 bushels, while at 75 cents per bushel the limit of profit is reached at about 27 bushels. At $2.00 per bushel all of the plats would yield a profit, and at 50 cents per bushel all of them would bring a loss. [See Diagram on opposite page.]

Thus yields that may be profitably secured during high prices are attended with loss as the market price falls. The highest yields are not an offset for the lowest prices. Reduced expenses and consequent moderate yields are the legitimate remedy for low prices. This seems hard doctrine, but it is Nature's method of adjusting the balance between supply and demand. As prices fall, profits per acre must decrease. This consequence is inevitable.

What is the lesson of these figures? It is plain and easy of application. During periods of high prices, great yields are profitable. The income per acre is large. Then is the time to manure heavily, to put the farm in the best possible condition, that it may be able to produce the best of crops at least expense when low prices shall come, as they surely will. We are now in the trough of the wave of prices. When the crest shall come, let us fortify ourselves against the succeeding period of depression by improving the condition of our soils.

Many a farmer is looking to the commercial fertilizers to increase his crops and his revenue. Don't do it. It costs now 84 cents for fertilizer—enough to raise a bushel of wheat, and so far as commercial fertilizers are concerned for growing *wheat* their residues do not remain in the soil. Under Lawes and Gilbert's treatment such plots fertilized ever so heavily showed no tendency to increased yield. There was no accumulated fertility. All this is not true of farm-yard manure. It does not cost cash; its residues do remain in the soil, and if liberally applied the land gains in fertility. Good home-made, old fashioned manure is the sheet anchor of good farming in this country.

Is all this an argument for *low* yields and poor farming during periods of low prices? No; it only asserts the fact that as the average yield increases the cost per bushel of increase rises, the profit on each additional bushel is less and less, till ultimately a point will be reached where the next bushel will cost more than it will sell for. Then it were better not raised at all, for it only swallows the profits of other bushels more cheaply raised. To persist in increasing the yield by producing the last bushels at a loss is poor farming. Profits per acre begin to decline when one bushel is raised at a loss. This is long before the line of cost crosses the line of income where the limit of profit is reached, and far below possible further increase. Thus in diagram 2 the greatest profit is at about 36 bushels, if at one dollar per bushel, but at 75 cents it is greater at 18 bushels than any at higher yield. So long as the space widens between the lines of cost and of income per acre (diagram 2) so long is profit per acre increasing. When they begin to approach each other, some bushels are produced at a loss, and the total profit is lessened. When they cross, all profit has been swallowed in growing the last bushels. Whatever the price, grow every bushel in

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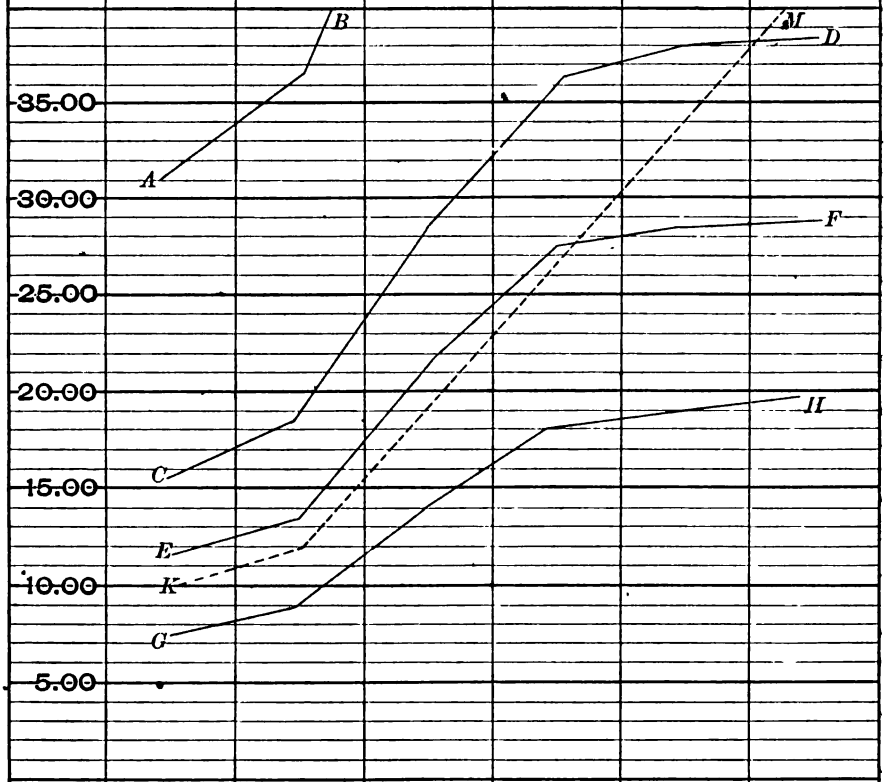

Kind of Fertilizer used.	No Manure	Mixed Mineral Manure alone.	Mixed Mineral and 200 lbs. Ammonia Salts.	Mixed Mineral and 400 lbs. Ammonia Salts.	Mixed Mineral and 600 lbs. Ammonia Salts.	Mixed Mineral and 800 lbs. Ammonia Salts.
Cost per Acre.	$10.00	$12.00	$19.50	$27.00	$34.50	$42.00
Yield per Acre.	15⅛ Bus.	18⅜ Bus.	28⅜ Bus.	36⅜ Bus.	38 Bus.	38½ Bus.

A B—Line showing income per acre at $2 00 per bushel.
C D— " " " " " " 1 00 " "
E F— " " " " " " 75 " "
G H— " " " " " " 50 " "
K M—Line (dotted) showing cost per acre at $10.00 per acre on unmanured land.

N. B.—The line A B extends above the diagram for the higher yields.

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which there is a margin of profit, then stop the increase, and the total profit will be the greatest possible.

Lawes and Gilbert secured about equal results with ammonia salts at $18.20 per acre at present prices here, with nitrates at $17.60 per acre, and with 14 tons of farm-yard manure per acre. If this be true, can any farmer afford to pay the $18.20 per acre cash for fortilizer that does not remain in the soil, as long as he can manufacture the 14 loads (tons) of manure at home. I do not know the cost or the value of a ton of manure, and nobody does; but I appeal the good sense of any farmer, if he cannot better afford 14 tons of good farm-yard manure, whose residues remain in the soil, than to pay $18.20 cash for commercial fertilizer "good for this day and train only?" particularly now, when $18 worth of fertilizer will not raise $18 worth of wheat.

SUMMARY.

In the light of these facts I am led to believe the following conclusions are fairly well established:

1. That up to a limit nearly double the natural yield of the soil, equal increments of fertilizer are answered by nearly equal additions to increase, then rapidly decline.
2. That the highest yields are not economical, and can be attained with profit only in periods of high prices, and that the highest *possible* yields would result in loss with everything below infinite prices.
3. That low prices compel reduction of expense and consequent lessening of yield.
4. That moderate dressings of farm-yard manure not only nearly equal the best results of commercial fertilizers, but that its residues accumulate in the soil, increasing its fertility.
5. That commercial fertilizers are profitable only during periods of relatively high prices.
6. That the limit of profitable increase fluctuates with the market price, but that most yields are far below that limit.

DISCUSSION.

Jacob Anderson favored heartily barn-yard manures, and gave his experience with commercial fertilizer at $40 per ton, recommended to increase the yield six to 12 bushels per acre. He proposed to hold the agent to the lowest estimate, and not pay him for it if it did not produce the six bushels increase. The agent reluctantly consented, but the manufacturers repudiated the bargain but offered, if he did not get enough increase to pay for his trouble, he need not pay for the fertilizer. *No* difference could be *seen* in the field. The company thought that the crop would probably yield and weigh more. It failed in both. It transpired that the land could raise 35 to 40 bushels without *any* fertilizer. He had had good results from barn-yard manure, liked *clover* the best when possible to use it.

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GREEN MANURING.

BY MR. JOSEPH SMITH.

Read at the Big Rapids Institute.

MR. PRESIDENT, LADIES AND GENTLEMEN:

When the pioneers of this county first settled here they found a heavy growth of timber upon the land, yearly adding fertility to the soil in shedding its foliage. As the timber had little commercial value, it was disposed of in the most wholesale method known, viz: By throwing it into huge windrows, and, when suitably dry and seasoned, setting fire to the fallow. After which the sturdy pioneer scattered the ashes to the four winds of heaven; if, perchance, he did not make potash, and thus commence a system of wholesale robbery of his land, which has been a prominent trait of the farmers of this part of Michigan.

In a majority of cases, all that became necessary to a successful crop, after clearing off the timber, was to sow the seed and drag it in, with anything that would cover up the seed. At harvest time a bountiful harvest was threshed and a large share of it hauled to the lumber camps. Then followed several crops of hay. These, too, followed the first crops to the camps. No wonder that in time the farm seemed to lack vigor and a stimulant became necessary to successful crops.

Now, as we very well know that merely placing back upon the soil, in the shape of barn-yard manure, what has been taken off in the sale of beef, butter, milk, mutton, wool and grain, will not maintain the fertility of our soil, we find the question staring us in the face: What are we going to do to keep on talking terms with our farms?

My early education inclined me to the belief that it was necessary to keep a large amount of stock in order to maintain the fertility of the soil, and that to raise largely of grain or potatoes would soon impoverish the soil. My own practical experience, coupled with observation, has thoroughly convinced me that farming can be carried on continuously and successfully without necessarily keeping more stock than will be useful in using up the unsalable products of the farm, such as small potatoes, corn fodder, etc., and at a greater profit and with less actual outlay in time and money, making the farmer less of a slave to his business, and allowing him to have a day to himself once in a while. This can be done by green manuring. Manure is that which has in it the elements of fertility, in an available condition, for plant food. Green manure is anything that can be grown upon the soil, and by being plowed under, in a green state, add fertility to the soil.

With the high prices we have been able to obtain for hay, and the correspondingly low prices offered for beef, butter, pork, mutton and wool, we cannot afford to raise those latter articles, expecting the manure to make good the losses that are sure to accrue on the manufactured products of the farm.

A man coming upon a farm too poor to raise clover, can sow to fall rye, and secure on very poor soil a large body of rye to turn down the following June, to be followed by flat turnips or spring rye and oats,—or, if the soil is strong enough, millet,—this again to be plowed under, and the land again sown to rye, and if needs be, again plowed down, until your land is rich enough to

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grow clover successfully, after which no trouble need be experienced in keeping up the fertility of the soil. "But," said a farmer to me the other day, "what are you going to do after three bad seasons, like we have had in Mecosta county, and almost all your seeding has been a failure on account of drought?" I reply, just what I have had to do. Plow up your stubble and sow flat turnips in the month of July or first of August, seeding down to clover and timothy; and as we generally get a fair amount of rain after our crops are past redemption, you will get a good stand of clover, and the large turnips may be taken off for stock or sold, thus helping to pay for seed and labor, and the smaller ones will wilt down over the clover later in the season, affording protection to the plant, while the roots will decay and give sustenance to the crop. Then continue to sow rye or turnips in your corn, rye in your potato ground, after you have harvested the potatoes, and in proper season plow down and plant, and when you get ready to seed down to timothy and clover you will have no trouble in doing so, as far as the richness of the land is concerned. This has been my experience for a number of years, and all will admit that our farm has been steadily improving.

I have not said anything about corn for green manure. My own observation (not experience, mind you, as I have had none) has not been as favorable as I had hoped.

The question now arises, is it not expensive? Let us see. To manure an acre of land forty rods from the barn-yard will consume the time of one team and two good men one day, so the figures stand thus for the barn-yard account:

Team 1 day and board	$2 50	
2 men @ $1.00 per day	2 00	
Board @ $3.50 per week	1 00	
Plowing under manure	2 50	
Rolling	50	
		$8 50

Green manure account:

Plowing 1 acre	$2 00	
Seed rye, 1¼ bushels @ 60c	75	
Dragging 1 acre	50	
Plowing under crop	2 50	
Rolling	50	
		6 25
		$2 25

Leaving, as you see, a balance in favor of green manuring of $2.25; and I have not said anything as to the value of the manure. You will observe I have only charged two dollars for plowing the clean land, as I can get it plowed for that any time, and you can hardly hire a man to do a good job at plowing under manure, so we place fifty cents more against the barn-yard manure account. Then, again, we have not taken into account the fact that often, as on corn and potato ground, rye can be sown without plowing, and in fact my own experience has proved to me that rye does better on well cultivated land than it does on mellow, plowed land, as, like wheat, it requires a firm undersoil to do its best.

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DISCUSSION.

Mr. Smith: I have not spoken of the benefit in green manuring of shading the land.

Dr. Beal: I consider this last point an excellent one.

Prest. Willits: Is Mr. Smith's land sandy?

Mr. Smith: One-half of it is, and when I went on I could hardly raise white beans. Three years after, by plowing in rye, I got 26 bushels of wheat per acre.

Prest. Willits: This is a point of great interest to us in connection with the experiments of the College at Grayling, in the treatment of the light pine lands.

Mr. Martin: After you get that land in clover, let it stay in clover some time, three or four or five years; then plow and you have it much bettered. Don't pasture. In cutting the clover, cut only one crop of hay each year and let the second growth go back to the land.

Dr. Beal: When animals eat rye or clover they don't take more than 20 per cent of the substance, and the remainder should be utilized as barn-yard manure.

Mr. Warren: I agree as to leaving light soil seeded down some time, but I would feed straw and top dress the clover with barn-yard manure.

Mr. Burnett: As to shading land. I have a light soil and planted corn three and one-half feet apart and got nothing. Last summer I planted four and one-half feet apart, kept it stirred and let in the sun and got 75 bushels per acre.

Mr. Ladnor: As to that, I had a field of wheat of which one-half had been in peas and the other half in summer fallow, and the pea land yielded as well as the fallowed land.

Mr. ———: On my soil clover does not hold good longer than two years. I had a crop of rye, some of which was eight feet high.

Mr. Smith: I want every farmer who has not tried green manuring to try it, and if you once try it you will never abandon it. You can by means of it sell your crops and keep up your land.

Mr. ———: I grew my last crop of potatoes following rye plowed under. As to keeping land in clover, it will often not stay but run out.

Dr. Beal: Clover is a biennial plant and will not follow itself unless it seeds.

HOW SHALL I KEEP UP THE FERTILITY OF MY FARM?

BY MR. HENRY STINCHCOMB.

Read at the Farmers' Institute, at Lake Odessa, Feb. 11, 1889.

Man, while in this life, is a success in proportion as he has a practical knowledge of the business in which he is engaged. If a physician, it is a knowledge of the science of medicine and of the human system. If an attorney, a knowledge of law.

Bread and clothing are our first wants—will be our last—hence the need of a thorough knowledge that we can use, along the line in which we are engaged, to aid us in honorably accumulating all the dollars we can, by obey-

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ing the oldest command: Six days *shalt* thou work. I hope you will bear in mind I am not speaking of our spiritual existence; that is quite a different subject.

Now, we, as tillers of the soil, want a knowledge that will aid us along our line.

Do I hear some one say if I wish to grow 40 bushels of wheat per acre I had better commence the study of anatomy and the science of medicine? And will a wise one tell me to become familar with Blackstone, Greek and Latin, before I can ever grow 400 bushels potatoes per acre? That is not the knowledge we need, we cannot use it in the growth of vegetation.

Life is short, we have only time to learn that which relates to our business. The farmer needs a broader education than any other profession, and the best place to acquire it, is first, on the farm; second, at our Agricultural College.

The profits of a farmer do not depend on the number of his acres, nor on the extent of his crops, but on the amount produced per acre above the cost. Now if this is true, the question arises: In what manner can we increase this extra production. The two principal agents are manure and thorough cultivation.

I do not think our soil can be stirred too much if done in the right time. Yet, I do not approve of barren fallows in hot weather. If a great amount of tillage is necessary to get rid of troublesome weeds or destroy roots of grass, I would substitute hoed crops.

I use large quantities of bedding for animals, and, so far as I can, keep both animals and manure under cover until they can go where there are growing plants to welcome them. Fire-burnt, rain-drenched manure hardly pays to handle. It certainly costs less to draw the manure, as it is made, to the field where it is wanted than it does after it is soaked in rain water. Manure is only available to plants in a dissolved or liquid state. Hence, after stable manure is thoroughly drenched with water, all that is at that time available is washed away. Now this is a big waste, when we consider that the urine is the richest in ammonia of any part of the manure. Bushels of wheat, oats, corn, potatoes and tons of hay are being washed from our manure piles every time it rains, and we don't seem to care.

Mr. Terry, of Huron, Ohio, who is excellent authority, uses nothing but box-stalls, and with absorbents and a sufficient quantity of water to keep the manure from burning, leaves it there till he wants it on the land. This plan seems to be the best of all.

I use walking hog-pens—that is, pens built on runners. I move them with a span of horses from time to time, and first one place and then another, wherever necessary, and at the end of each year I have from one to three acres by this means rich enough for any crop, and I never had a sick hog on my farm, while some of my neighbors, with their dirty, filthy, stationary pens, lost all they had. Then they said they had bad luck. Some one said centuries ago, "All flesh is grass." At least all successful farming is founded on grass. This term I use in its broadest meaning. Where red clover can be made to grow well without manure, there is no difficulty in sustaining the fertility of the soil without the use of commercial fertilizers. I used to sow four quarts of clover seed per acre; not so stingy now, I sow one peck per acre.

Would it not be well, the last time we plow our corn, to seed the field to

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rye for fall and spring pasture? Who has tried it? tell us your experience. Will we not all agree that the more vegetable matter we can get into our soil the better? Why? Not to make it loose—it is already loose enough. Then why this food of humus? Simply to make it rich, productive, grow large crops. We all know that our land, practically, is productive or barren, just about in proportion as it contains vegetable matter. But will it not be in this part of Michigan, as in all others, and hereafter as it has been heretofore? That is, those who work into their lands most green crops, especially clover, and those who most carefully husband all the good, old-fashioned barn-yard manure they can make and most judiciously apply it, will grow the biggest crops and make the most money. We must give and take with the soil. If our crops extract nourishment from the soil, we must replenish it with the food elements extracted from it; otherwise future crops will suffer for want of food, and consequently diminish and ultimately entirely fail. When we cease to let our hens and turkeys roost on the fence and in the tops of fruit and shade trees, stop the rain from our barn roof drenching the manure pile, quit emptying the ash pail in front of the parlor door, don't put those bones in the stove and burn them, and learn that all decomposition is wasted to the farm unless some plant or absorbent is on the spot to drink up the gases, then it may be time to talk of guanos and superphosphates.

Mr. Watt: I think Mr. Terry's idea of keeping stock in box stalls, on their own manure, is not good for the animals.

Cropping, of itself, does not fertilize, but cultivation while cropping is necessary, and with corn should be continued till the ear is glazed.

Mr. Spaulding: I object to sowing a peck of clover seed per acre; we can't afford it. One pound of clover seed has so many seeds that at four quarts per acre 151 seeds would fall on every square foot, and two quarts will make a fine crop.

Mr. Friend: I have sown four, six and eight quarts, and now always sow eight. My farm is clay. When the land was new I found four quarts enough.

As to having stock tread their manure, I find the best results to give abundance of straw and leave the manure till spring.

Mr. Spaulding: My soil is heavy clay loam. I have sown three and four pecks of wheat per acre, and think four more than necessary.

I sow ten pounds clover seed per acre.

Mr. Friend: The *theory* of little seed is good, but in practice more is useful.

Mr. Carter: If I wanted to follow corn with oats, I would manure the sod before plowing for the corn.

As to clover seed, a rich, strong soil needs less seed than a lighter soil.

Mr. Watt: Manure should be hauled to the field and spread when hauled in the winter.

Mr. Morgan: Manure for wheat should be worked in on top after the plowing, and be spread as hauled and not dumped in piles.

Mr. Johnson: In Western New York, one spring, clover seed was high and a neighbor sowed eight quarts of seed on 16 acres, with splendid success.

Prof. Johnson: As to the cultivation of soil 100 years ago, Jethro Tull experimented thoroughly on the value of culture alone, and maintained that he could do without manure, but nevertheless his wheat grew less and less year by year in spite of his efforts.

Last year I saw Terry's farm, and found him a sensible, practicable, level-

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headed man. He advocates keeping manure under cover, and his horses in box stalls.

My opinion is in favor of hauling manure as soon as possible when it is made, and spreading it as hauled. We haul a wagon load every morning and never have a manure pile.

It seems to me wise to buy commercial foods rather than commercial fertilizers, and this is much more profitable than raising wheat.

SILO AND ENSILAGE.

PROF. A. J. COOK.

Report of a Lecture at the Centerville Institute, February 19, 1889.

I have great faith in ensilage as an aid in solving the problem of maintaining the fertility of our farms. It is too bad for us to rest content with crops of 12 to 14 bushels of wheat per acre. In New York good farmers are dissatisfied with less than 25 to 30 bushels. These results they do not secure by the use of commercial fertilizers, saying that they are too costly to be used with profit, and that it is barn-yard manure alone to which we must look for salvation. To increase our manure pile we must keep more stock, and it is here that the silo comes to our rescue by enabling us to feed fifty per cent more live stock from a given acreage than we were able to do with dry feed. Hiram Smith, of Wisconsin, maintains that with ensilage he can feed double the number of animals that he can without it.

It is said that seeing is believing. I have a neighbor who is possessed of an inordinate dread of getting into debt, and yet, after seeing my silo, he said that he was determined to build one for himself at once, even if he had to go in debt for it.

A silo is nothing more nor less than a frost-proof, air-tight box, dry at the bottom. You can build it in your barn to advantage if you can spare the room for it there. My silo is 20 feet high. I would like 25 feet high better. Locate it wherever it will be most convenient to the mangers for feeding. The level of the bottom of the silo should be about 18 inches below the level of the ground, and the trenches for the outside walls should be enough lower than this to be safely below frost. This will usually vary from 1 to 2 feet, according to the soil and drainage.

This trench should be 18 inches across and filled with stones up to the level of the bottom of the silo. From there to the surface of the ground build, even with the outside line of the trench, an 8-inch wall and on the 10-inch ledge thus left place flatwise two 2x10 plank to which to toenail the studding. This should also be of 2x10 plank placed 16 inches between centres. The object of this arrangement is to provide a firm backing for the bottom of the studs to enable them to withstand the outward pressure, and to insure this it will be well to tamp the soil firmly against the foundation wall.

Against the studding on the outside put a layer of building paper and one thickness of boards running horizontally, and on the inside put grooved board-lath, and onto this a coat of cement like a cistern lining. This will cost about 10 cents per square yard for mason labor, besides tender and material.

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If you can make matched lumber coated with tar equally water tight and cheaper, all right; but I question the possibility of its being made as tight as the lath-board and cement.

If you use tar it will be the better for having some resin mixed with it.

Make a door 2½ feet or 3 feet wide, extending from the sill at the bottom of the silo to within 2 feet of the top, so as to *always use the ensilage from the top only*, as that is altogether the best way to use it, because cutting vertically exposes too much of the mass of the ensilage to the action of the air.

As you fill the silo, close this door with paper and boards inside and out, nailing the outside boards securely so as to prevent spreading. Be sure to build stroggly enough so that the weight of the ensilage will not spread your walls.

One cubic foot of ensilage weighs on the average 40 pounds, so that a silo 10x10x20 feet would hold 40 tons, or, at 15 tons per acre, the product of 2⅔ acres, and a silo 15x15x25 feet would hold 112½ tons, the product of 7½ acres.

My silo, 15x15x20 feet, built as I have described, and all done by hired labor, cost $126.88.

It has been suggested that the weakening effect of this vertical doorway can be avoided by substituting for it a chute built next to and inside of the wall and emptying through a small opening in the wall at the bottom. Thus the inside of the chute can be made with removable sections, to be nailed into place as fast as the silo is filled, while the outer wall can be made continuous and thus preserve its full strength to resist spreading.

Do not think of building a stone or brick silo. If you wish to put ensilage in some such place that is already built, it will be better to line the inside with boards.

The silo being finished, how shall it be filled?

In the first place, for ensilage, choose the same variety of corn that you would prefer for other use—whichever variety gives you the best yield of corn. If you try a new variety, venture only a small trial at first and place your main dependence on something that you are acquainted with. I tried Southern corn and did not succeed with it. It makes a great growth of stalks, but did not mature much grain. Plant in the same way as for other purposes. I plant in drills, using the Farmers' Friend Drill, of which I close all but the two outside feeds. This makes the rows 4½ feet apart. I regulate the feed so as to plant about 10 quarts of seed per acre for flint corn, which usually gives about one plant every four inches. Larger varieties should stand from eight to twelve inches apart in the row.

My system of rotation is grass two years, followed by corn, oats, wheat and then grass again. I manure the grass the winter following the second year and plow in the spring, planting about May 20 and dragging twice before the corn is up and occasionally afterwards until the corn is six inches high. Then I begin to cultivate and never use a hoe. The early and frequent dragging has killed all the weeds when they first started and there is no need to hoe.

Let the crop mature as well as if you intended to husk it. The earlier practice was to cut it too soon, but it should never be cut until the kernel has begun to glaze, as in cutting earlier than this you fail to get the full nutritive value of the crop. Just before corn dries off it is most nutritious.

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After that its outer coat hardens and it becomes less nutritive—or rather less digestible.

Never put corn into the silo when the dew is on it, nor when it is wet from rain. Corn can be ensilaged without cutting the stalks, but to do it successfully requires so much care, and even with all the care possible there is so much risk of failure that it is just about as cheap and much safer to cut it. This should be done with a power cutter, set so as to cut the stalks (ears and all) into about one inch lengths. I use the Morton tread power, and like it very well. It is easily moved from one barn to another and has a perfect governor. With this I use the Smalley No. 14 cutter. It cuts into inch lengths very rapidly, but does not cut finer than that as well. I have tried five different cutters and of the five I like the No. 14 Smalley best. I have not tried the Ross, but hear it well spoken of. It costs more than does the Smalley, and the knives are hard to remove for grinding.

To harvest to the best advantage have two men hauling, two men cutting in the field, who will also help load the wagons, one man at the power cutter and one lively and faithful man to tread the ensilage as it is fed by the carrier into the silo.

I have tried a Buckeye reaper to cut the corn, but do not find it as good as the old way.

A platform wagon is the most convenient for hauling.

The treading is a very important matter and must be well done all around the sides, and especially in the corners. The middle need not be trodden. The object of the treading is to make the mass compact, and with as little air included in it as may be. The weight of the middle will settle it, but the friction of the side walls prevent the edges and corners from settling solidly enough without the help of the tramping.

You may fill as rapidly as you please if you follow these directions. There is no necessity for delay except for nights, Sundays, and when it rains or the corn is wet.

After filling the silo, let it settle for a couple of days, and then fill up snugly once more, and, after letting it settle again, cover over the top with a two feet layer of cut straw and the work is done. You can nail up the door until you are ready to begin feeding. In my opinion, weights on the ensilage are entirely unnecessary, if the treading has been properly done.

If you want to put in clover early in the season and corn later, separate the two by a good layer of straw, but corn is so much better for the purpose that I would never make ensilage of clover.

Begin to feed whenever you please, raking off evenly from the top what you wish to feed each day and keeping the surface about level.

If for any cause you should stop using the ensilage for a while after having begun on it, cover it up again with cut straw as at first.

Sixty pounds of ensilage per day is a good ration for a full grown cow or horse, so that at only 12 tons per acre one acre would supply such an animal 400 days. Many people claim to have raised 20 or even 30 tons per acre. I have found 15 tons a fair crop.

It will not do to begin by feeding animals a full ration of ensilage all at once, but begin gradually, just as you would not give unlimited green grass all at once.

It is excellent food for all farm live stock. It is the best thing in the world to feed to the mothers of fall colts and calves.

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Animals always relish the ensilage and eat it up clean, butts, cobs, and everything. I have tried in my barn mangers, putting ensilage on one side and good, bright hay and ground feed on the other, and the animals took the ensilage first every time.

They thrive on it, too. Col. F. D. Curtis, Prof. Ladd and I visited together the barns of Mr. Woodward, the secretary of the New York State Agricultural Society. He was feeding 200 head of cattle, half of them on ensilage and the other half on hay, and had given the hay half into the care of a young man who had no faith in ensilage and was determined that hay should beat in the trial.

Now you may turn those 200 animals into a field together and I will agree to pick out not fewer than 95 of the 100 ensilage fed animals on account of their better appearance.

My judgment of the value of ensilage is that by its means you can add 50 per cent to the number of your live stock, to your manure pile, to the fertility of your farm and to your pocket.

Remember if you have a farm of 100 or 200 acres, that if you build your first silo not more than 15 feet square it will not be long before you will be building another one because the first one is too small.

Ensilage is of itself a very good complete ration. It is grain and fodder together. But if you prefer you can feed hay or bran or cotton meal in connection with it, and perhaps it is best to give occasional variety in some such way. It costs me less per acre to make ensilage of my corn than to harvest it in the old way.

Three tons of ensilage are worth about the same for feeding as one ton of good hay.

SEEDS.

BY PROF. L. R. TAFT.

Read at the Farmers' Institutes, at Grayling and North Lansing.

The vegetable kingdom may be divided into two great classes, one containing the flowering and the other the flowerless plants.

To the latter belong the ferns, lichens, fungi and other cryptogams, which reproduce by what are known as spores, while all other plants may be placed in one great group whose ultimate object seems to be the reproduction of its kind, by the development of seeds. These are the phænogams or flowering plants. In their production of seed we find a great diversity in the habits of plants; some known as annuals, like corn, oats and melons, produce a crop of seed the first year, and then die; the biennials, as beets and turnips, during the first year store up, either in the root or stem a supply of food to be used the next year in the production of a seed stalk and seeds, while the perennials may live for a series of years, and like the century plant, die after the production of one crop of fruit, or may live on, year after year producing their fruits annually, or at frequent intervals.

There seems to be in all plants a certain degree of vigor from which maximum results can be obtained, and if they are allowed to vary from this condition the growth of the plants, especially in the case of perennials will be in inverse proportion to the seed production.

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It is well known that any cause which produces a rank growth, does so at the expense of fruitfulness, while if the growth is checked or the food supply cut off, all the energies of the plants are exerted in the production of seed. This is a wise provision of nature as, while plants are young and vigorous, there is slight need of immediate provision for the future, but when they become old or weakened by disease or injuries, strenuous efforts are made for the perpetuation of the species.

Although all parts of the plant are requisite for its perfect development, the flowers alone are directly concerned in the production of seed, and hence may very properly be termed the reproductive organs. The essential parts of the flowers, or those without which no seed can be produced, are called stamens and pistils. The stamens generally consist of slender stalks called filaments which bear on their tips the pollen sacs or anthers. The pollen formed in the anther sells is generally a fine yellowish or brownish powder. The pistil consists of a swollen portion called the ovary, which contains the ovules, and tapers upward forming the style, at or near the end of which is a point called the stigma. The stigmatic surface is generally roughened and covered with a sticky fluid. The essential organs may be grouped together in the same flower, they may be in different flowers on the same plant, or even upon different plants. For the protection of the essential organs, nearly all plants have at least one row of covering leaves called the calyx, and generally we find an inner row, the corolla.

While the chief object of these parts is the protection of the stamens and pistils, they are often large and of bright colors, and thus serve the important purpose of rendering them conspicuous, that they may attract the attention of insects. In addition many flowers exhale strong odors for the same purpose.

When the pollen grains are ripe, the anthers burst, and the pollen is transferred to the pistil. Sometimes it is carried to the stigma by the bursting of the anther, or by movements of the stamens, but generally it is through the agency of insects, or the wind. The sticky surface of the stigma retains the grains, and they develop a slender tube which passes down through the style to the ovary, and there enters one of the ovules. A portion of the protoplasm of the pollen grain passes along the tube, and entering the ovule, fertilizes the embryo.

In order that all of the ovules may develop, a pollen tube must be sent down to each one of them, and to make fertilization sure, a great number of pollen grains are developed, one plant, wistaria, providing seven thousand for each ovule.

Such plants as require the aid of insects to convey the pollen to the stigma, secrete a sweet liquid, called nectar, in some part of the flower. The insects, attracted by the color or odor of the flower, enter and obtain the nectar. In doing this they brush against the anthers and more or less of the pollen adheres to them, going to the next flower the pollen is brought in contact with the stigma.

There is a wonderful adaptation in the parts of the flowers. Many blossoms are visited by moths which fly at dusk, and that they may more easily find them they are generally white and are very odorous; flowers of a dull yellow are never visited by beetles, but are fertilized by flies and bees; some plants bear flowers which never open, while others mature their pollen before the petals expand, and in these cases they are self-fertilized. The majority

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of plants, however, especially if the work is done by insects, are fertilized by pollen from other plants. This desirable end is accomplished by various modifications of the flowers. In some plants one set of organs matures before the other, so that if the pistil is fertilized it must be done by pollen from other flowers.

Sometimes plants will bear long stamens and short styles, while other plants of the same species will have short stamens and long styles, an arrangement which renders the pistils likely to be fertilized by pollen from other plants. In other cases the flowers have various appendages which cause insects entering the flowers to come in contact with the pistil, thus depositing the pollen, but on leaving, laden with pollen from the anthers, the same, or other appendages shield the stigma from its touch. Nature is very economical, and it is evident that all this pains would not have been taken unless cross-fertilization is of some value to the plant. Experiments by careful and painstaking observers have shown a marked difference, both in the growth of the plants, and in the production of seed; it is noticeable in the first generation and a continuance causes the difference between close and cross-bred plants to be still more marked.

In a series of experiments by Darwin,[1] with plants of morning-glory, it was found that in the first generation the crossed plants made a growth one-third greater than those grown from self-fertilized ovules, and the number of seeds produced was one-half more. The experiment was continued, one set of seeds being cross, and the other self-fertilized, and the tenth generation produced nearly twice as much growth in length, from cross-fertilized seeds, as was obtained from those self-fertilized, with a weight two and one-half times as great. In the production of the crossed seed the pollen was taken from different plants of the same generation, and as this was kept up, the plants became quite closely related, and it came very near being in-breeding. To see if the introduction of fresh pollen of a different stock, but of the same variety, would have any effect, plants of the ninth generation were fertilized, some with distinct pollen, and others intercrossed as usual. The result was, that the plants fertilized with fresh pollen made a third more growth, and produced twice as much seed as those intercrossed.

The introduction of fresh pollen in a similar experiment with musk-plant gave still more marked results, as the growth was as 100 to 56, and the seeds produced were as 100 to 4, compared with plants grown from intercrossed seeds.

Another interesting experiment indicates that plants produced from ovules fertilized with pollen from the same flower are as vigorous as those fertilized with pollen obtained from different flowers on the same plant.

While some kinds of pollen must be used at once, that of other plants will remain fresh for a number of days, and in some cases has been found active at the end of a year.

The pollen of some kinds of plants will begin the development of pollen tubes within a half minute after reaching the stigmas, but other species require from twenty-four to thirty-six hours. The time necessary for the tubes to reach the ovules also varies greatly, generally being only a few hours, but sometimes days and even weeks elapse before the journey is completed.

[1] Cross and self-fertilization in the vegetable kingdom, p. 28-41.

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Having been properly fertilized, the ovary develops and forms the fruit, and the ovules become fully developed seeds.

Botanists are not agreed as to whether the influence of the pollen is confined to the ovules or extends to the ovary walls and receptacle. While many are convinced that the effect of a cross can be noticed in a strawberry, orange or apple, others are equally sure that the ovules or seeds are alone influenced.

Very often some peculiarity will appear in a fruit, and it is very easy to account for it by attributing it to a cross. On the other hand, in the experiments of Prof. Bailey, and similar ones conducted at the Ohio and Iowa stations, when the plants were artificially crossed and foreign pollen excluded, no result was noticeable the first year, indicating that the effect of the pollen did not extend to the ovary or receptacle.

When Crookneck squashes are fertilized with pollen from a White Bush vine the result is, to all appearances, Crooknecks; but if the seeds of these squashes are planted the fruits produced will resemble neither parent, but will possess characteristics of both. The fruits will be white, and in some cases will be flattened nearly as much as the White Bush, but generally will have a thick neck, shorter than a true Crookneck. They will be ridged or scalloped like the Bush, with the warty appearance of the Crookneck.

In 1887, at the College, White and Yellow Bush, Yellow, Orange and Green Crooknecks and several other varieties of squashes were planted and allowed to pollenize each other. In the fall, seeds of nineteen squashes were selected, and when planted in 1888 gave some wonderful results. The seeds taken from a single squash produced vines no two of which bore fruit that was anything alike. Thus, the seeds from a very crooked Orange Crookneck produced one vine that gave fruits that approached the White Bush, another evidently a cross with Yellow Bush, a third whose fruits were dark yellow, nearly smooth, and approaching the Crookneck form, and others all the way from a straight-necked fruit to the very warty and crooked form of the original squash. This would indicate that the pollen from a number of plants might share in fertilizing a single pistil, and as the fruits on any given vine resembled each other in form and color it is an additional proof that the pollen affects only the ovules.

Seeds, or matured ovules, are miniature plants. They are of various shapes and sizes and consist of two covering or seed coats, and a nucleus made up of the embryo, with its endosperm or food mass. The outer coat, or testa, is firm and often hard and thick, and may be smooth, ridged, roughened or marked in various ways. Sometimes it is provided with hooks, awns, hairs or winged expansions which aid in the distribution of the seeds. The inner coat, or tegnum, is generally thin and dry.

The embryo consists of the radicle, from one end of which the root develops, while at the other are one or more seed leaves, or cotyledons, and a bud, or plumule, which gives rise to the stem.

The endosperm is generally starchy or oily, and is placed in the seed for the purpose of nourishing the young plantlet during germination. Sometimes the embryo is largely developed and the food mass is stored within the seed leaves, as in the squash and bean.

When seeds are fully ripe, nature provides in various ways for their distribution and planting. Some are thrown several feet by the bursting of the fruit or the contracting of the receptacle; others fall into streams, and

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are carried perhaps hundreds of miles before they lodge on the banks. Many seeds have appendages by which they are borne about by the wind. The testa of cotton seeds is entirely covered with long hairs, the cotton of commerce, while others, as milkweed, have tufts of hairs large enough to buoy them up. The keyed or winged seeds of maple, ash, elm and catalpa are sometimes carried long distances both by wind and water. The thistle and many other forms of the compositae, have a hairy pappus, an outgrowth of the calyx, by which the seeds are scattered. Many fruits are eaten by animals and the seeds are thus widely distributed. The beggar ticks (*Bidens*) and beggars lice (*Desmodium*), with their barbed hooks and hairs, are notorious deadbeats in securing free transportation, and attach themselves to the coverings of man and animals with a pertinacity worthy of a better cause. The seeds of some of the Australian grasses, not content with fastening themselves to the wool of sheep, use their awns for boring into their bodies, and sometimes their internal organs become filled with them.

Most seeds germinate in the ground, but some plants are parasites and force their roots into the stems of other plants. Such seeds are covered with a sticky substance, and when they fall on a branch this holds them fast until they have taken root.

Commerce is also, unwittingly, responsible for the dissemination of seeds, as the hay and straw shipped from one part of the country to another, either as fodder or as a packing for fragile articles, is often full of seeds, many of them those of injurious weeds which spring up and occupy the land. Grass and other fine seeds often have seeds of noxious weeds mixed with them; and the importation has been carried so far that more than one-half of our worst weeds are of foreign origin.

Nature plants her seeds by covering them with leaves and grass, or assists them to work their way into the soil by an alternate freezing and thawing in the spring.

The agricultural seedsman does not trust to Nature's planting, but carefully gathers them, and when seed time comes commits them to the care of mother earth. Seeds are capable of germination long before they are fully ripe. If immature seeds are planted the per cent of germination will probably be low, although it will take place quicker than with ripe seed, and as the food supply of the plantlet is limited it will be weak and feeble, but if in rich soil, they may become strong plants ripening a full crop, earlier, perhaps, than ripe seed. Experiments thus far conducted do not favor the use of immature seed, although there may be a time, as the seeds are approaching maturity, when they can be gathered, and will produce ripe fruits, slightly earlier than if allowed to reach their full development.

Experiments in which the seeds were selected from different parts of the plants, or of the fruits, have been tried, but, everything else being equal, without decided results. Experiments with seed corn comparing the yield of the six rows of kernels at the tip, the six middle rows, and the six rows at the butt of the ear, indicate that, from an equal number of plants, the yield of the tip kernels equals, if it does not exceed, that of the middle and butt kernels, but to balance this the latter have a slightly higher germinating power.

The very best results have been obtained from the use of selected seed, and not only have beneficial effects been secured by choosing the seed from the most perfect fruits, but large and fine fruits are reproduced in their

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progeny, while plump and perfect seeds give better results than smaller ones from the same fruits. The results are not quite definite as to whether the influence of plant, fruit, or seed preponderates, but one cannot go astray if he selects large and plump seed, from the most perfect fruits that grow on the healthiest and most productive plants. This, of course, must be done in the field before the crop is harvested.

There is probably a slight gain in the time of ripening if seeds are selected from the first ripened fruits. Last year seventy-five kinds of tomatoes were grown in duplicate at the College, with six hills from seed of the first fruits that ripened in 1887, and the six adjoining hills from some which matured three or four weeks later. The first picking was made, last year, on the 17th of August and 242 fruits weighing 572 ounces were obtained from those grown from the first ripe fruits of 1887, and 174 fruits weighing 450 ounces from the others.

It is an interesting fact that of the angular sorts, which naturally ripen early, the yield was 178 fruits weighing 425 ounces, and 37 fruits weighing 107 ounces respectively, for the early and medium fruits. While of the apple-shaped sorts, most of which ripen later, the seeds from the first fruits of 1887 yielded 67 fruits weighing 147 ounces, and the plants grown from the main crop of seeds gave 137 fruits weighing 343 ounces; or in other words, the angular sorts gave five times as much fruit at the first picking from the seed of the first ripe fruits as from those which ripened later, while the apple-shaped sorts gave less than one-half as many.

Although potatoes are tubers, and not seeds, an experiment conducted at the New York station, to show the value of seed saved from the most productive plants, is worthy of mention at this point. In 1883 the tubers from the most productive hills in each of nine varieties, and also those from the least productive hills of the same kind, were gathered and placed in sacks, the product of each hill by itself. The following spring the smallest and largest tubers in each sack were cut to single eyes and planted, making thirty-two hills for each of the nine varieties. They were harvested and the thirty-six lots were carefully weighed. As might be expected, there was some variation, but the following was the average for the nine varieties reckoned for one hundred hills:

		Merchantable.	Total.
From most productive hill,	Largest tuber	83.4 lbs.	106 lbs.
	Smallest tuber	69 lbs.	88 lbs.
From least productive hill,	Largest tuber	66 lbs.	85 lbs.
	Smallest tuber	45 lbs.	69 lbs.

No better illustration than this can be given of the value of selection, as not only does the yield of the largest tuber from both the most productive and the least productive hills exceed that of the smallest tubers of the same hills, but the smallest tuber from the most productive hill yielded more than the largest tuber in the least productive hill.

The methods of gathering and preserving seeds vary with different plants, as some seeds will not germinate after becoming dry and must be sown at once, while others require a period of rest. The seeds of nearly all trees should be gathered as soon as ripe, and either planted immediately or placed in thin layers in sand or well drained soil to be planted the following spring. On the other hand, seeds of most of our vegetables and grains

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should be gathered when fully ripe, cleaned, carefully dried, and put away where they will be safe from mice and other vermin.

The failure of seeds to germinate is often owing to the fact they have not been properly dried, as when improperly dried seeds are packed away in large masses, fermentation is likely to set in, and the germs will be destroyed. When exposed to frost, the effect on such seeds will also be very injurious, and may be sufficient to render them utterly worthless. The Ohio station has tested several hundred samples of seed-corn, cured under varrious conditions, the result being that of the varieties selected in the fall, either in the field or at the time of husking, and carefully dried, either by spreading in thin layers or with a fire, 95 to 100 per cent germinated, while of those stored in the crib and selected in the winter or spring and tested at the same time, only 70 to 80 per cent germinated. The average of several hundred tests of corn sent to the station by farmers who selected it from their own seed-corn and forwarded it to the station to be tested for them, showed a difference of seventeen per cent, in favor of the well dried samples.

After the seed has been dried it should be kept in a moderately dry place, and while it is best to avoid extreme temperatures, thoroughly dried seed can be subjected to a considerable range without appreciable loss. To test this question, Mr. Devol of the Ohio station selected several samples of seed-corn from the same lot, and after thoroughly drying them exposed them to varying degrees of temperature and moisture. One lot was placed in a barrel in a cellar, another was suspended over a boiler where the temperature often reached 100°; a third sample was placed in a crate and covered with other corn in a crib, and a fourth was hung where it was sheltered from rain, but exposed to the changing temperature, and when tested in the spring they germinated nearly as well as when first dried, averaging for the four lots, 97 per cent against 98¼ per cent, in the fall.

The length of time during which seeds will retain their vitality varies with different species and the conditions to which they are exposed. While some of the tree seeds are worthless if kept dry for more than ten or twelve days, others need a period of rest, and after being dried can be used at any time so long as vitality lasts. Nearly all garden seeds, if properly cared for, are as good the second year as the first, and when the fruits are the valuable part of the crop as with melons, squashes, cucumbers, etc., seed two or three years old is sometimes preferred to new seed, as the latter has a tendency to run to vine rather than fruit.

The onion and parsnip are only safe for one year, and seed that is two years old should be carefully tested before it is used. Under right conditions, from 25 to 35 per cent of four years old seed will germinate.

Of the seeds good for two years are beans, peas, corn, rhubarb, salsify, carrots, egg-plants, peppers and okra; seeds of lettuce, asparagus, parsley, spinnach and radishes are generally safe for three years; cabbage, cauliflower, celery and turnip seeds can be used when five years old, and beet, cucumber, melon, squash and tomato seeds should germinate when six to eight years old.

Of course, these ages cannot be relied upon in all cases, and the only safe way is to test the seeds before using them, as tomato and other seeds with strong vitality if kept in a cold, damp place may not be good after the first year, although

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Tomato seeds 12 years old have tested as high as 98%.
Squash " 14 " " " " " " " " 60%.
Beet " 15 " " " " " " " " 50%.

Many seeds have even greater vitality than this. DeCandolle mentions a number of species which germinated when fifteen years old, nearly all belonging to the Leguminosæ or Malvaceæ. About twenty have been found to germinate when twenty to thirty years old, and Colutea and Coronilla still retained life when forty years old. Seeds of Nelumbium and Datura are said to have sprouted when more than one hundred years old. DeCandolle speaks of Nelumbium speciosum seeds over one hundred and fifty years old that sprouted.

Some fifty years ago the story started that wheat from the wrappings of the Egyptian mummies, two thousand or more years old, had been made to germinate, but the statement is no longer accepted.

Seeds, deeply buried in the soil, are often capable of germinating after a long series of years has elapsed. When deep enough to be away from the influence of the air and kept at a low temperature, the presence of moisture does not seem to be injurious, and many seeds germinate after having been buried forty or fifty years. A few years ago Dr. Beal found that a large per cent of the seeds of some of our worst weeds, that had been buried in bottles in a sandy knoll for five years, germinated, and it is possible that many others, of which the seed coats alone remained, had sprouted while still in the soil.

When seeds are exposed to moisture and the air at certain temperatures, a process known as germination takes place. There is a wide range of temperature at which seeds germinate; some will throw out their radicles when at or slightly above the freezing point, while others require more than 100°.

There is, for all seeds, an optimum temperature which favors germination, being, in the cases of wheat, barley and rye, from 75° to 85°, and for corn, beans and squashes, from 85° to 95°.

The temperature has a marked effect on the time required for germination. Thus, while rye is four days in germinating at 41°, it requires only two days when exposed to a temperature of 51°. Indian corn requires a slightly higher temperature, but the effect is the same.

At 60° corn begins to germinate in 144 hours.
" 77° " " " " " 56 "
" 87° " " " " " 48 "
" 97° " " " " " 48 "
" 112° " " " " " 80 "

Willow seeds push forth their radicles in a few hours, but most seeds require several days, while some kinds of tree seeds do not germinate until the second year.

The first step in the process of germination is the absorption of water by the seed, causing it to swell and often to burst its coverings. The common cereals absorb from 40 to 50 per cent, beans and peas 100 to 115 per cent, and clover 125 per cent of its weight of water. This absorption causes a slight rise in temperature of the seed.

The contents of the endosperm must be in a soluble form before they can be utilized by the embryo. The sugars are already soluble, but the oils and starch must be transformed into soluble carbhydrates.

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The change of the insoluble starch into soluble gum and sugars is brought about by fermentation produced by the action of a ferment called diastase. No fermentation can take place without the presence of germs, for whose action a supply of air is necessary. It is thought that there is an oxidation of carbon and an evolution of carbonic acid during the process of solution.

Oxygen is also required for the assimilation of the dissolved food by the growing parts. The greater portion of the young plant is made up of cellulose. The glucose, or sugar, in solution is transferred to the growing portion of the embryo, and uniting with oxygen forms cellulose, with an evolution of carbonic acid.

$$\underset{\text{Glucose.}}{2(C_{12}H_{24}O_{12})} + \underset{\text{Oxygen.}}{24\ O} = \underset{\text{Carbonic Acid.}}{12\ (CO_2)} + \underset{\text{Water.}}{14(H_2O)} + \underset{\text{Cellulose.}}{C_{12}H_{20}O_{10}}$$

The other elements of the seed also become dissolved and transferred to the embryo, and the process goes on, provided the conditions remain favorable, until the food supply is exhausted, or the plant is able to obtain nourishment from outside sources. The radicle develops rootlets and sinks downward, while the plumule pushes upward into the air and light, thus completing the process of germination.

In order to determine the value of old seeds, or of seeds purchased, it is well to test their germinating powers before planting them. This can very easily be done by anyone by wrapping them in cloth, placing them between sheets of blotting paper, or in soil, and keeping them moist and warm for a few days.

It is thought by some that light is prejudicial to germination, and that seeds must be covered in order to have them sprout. It has been found, however, that the value of covering seeds was not owing to their deriving any benefit from being in the dark, but because it enabled the planter to regulate the heat and moisture, and, other things being equal, seeds germinate just as well in the light as in the dark.

The use of various gases and solutions of oxidizing substances has often been recommended to hasten and assist germination, but no valuable results have been obtained. It seems probable that common air and pure water contain all the elements, in the exact proportions, required for the germination of seeds.

The time of sowing seeds and the depth of covering them are determined by the foregoing principles. The quickest and best germination can be obtained only when the soil has been warmed to the optimum temperature, and ordinarily it will be found unwise to commit seeds to the soil until it has an average temperature of 45° for such as peas, beets and radishes, and 55° for corn, squashes, and beans.

The depth to which seeds should be covered is determined by the size of the seed and the nature of the soil. Large seeds have a store of food which will enable them to make their way through several inches of soil, and may be planted deeply, which small seeds, if buried to any depth, would exhaust their substance before reaching the surface, and a very slight covering, or perhaps no covering at all, should be given them.

In order to obtain the best results the seeds should be planted to a depth which will secure them permanent moisture, as drying out would injure them and if repeated several times might prove fatal to them. On light soils

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inclined to dry out, and through which the plantlets can easily make their way, the depth of covering should be considerably greater than on heavy soils.

Many seeds raise their seed leaves above ground, and if covered with but a shallow layer of soil, the seed coats do not become detached and either check or entirely prevent the growth of the seedlings.

On light, sandy soils, large seeds, such as peas, beans and corn, may be placed from three to five inches deep with good results. Some of the plants may fail to reach the surface, but those that do will make a stronger growth, produce more fruit, and in case the season is dry, will withstand the drought much better than if placed one or two inches deep.

Seed should never be sown when the soil is so wet as to work like putty in the hands, but when it is friable or crumbles after being compressed it is in good condition for the seed. Especially if the soil is light and dry, it should be rolled, or in some way compressed after the seed is sown, thus firming the soil and preventing the evaporation of moisture. When well compacted they germinate in from a third to a half the time required in loose soil, while the plants will be much stronger. Peter Henderson, in his writings, very properly lays great stress on what he terms the "use of the feet" in sowing seeds.

Much has been said of the comparative merits of commission or grocery seeds, and those obtained directly from seed houses. The tests thus far show that although many individual packets of seeds sold by commission houses germinate as well or better than those obtained directly from the growers, the latter, as a rule, have a considerable higher germinating power. When seeds are obtained directly from large dealers there will be less danger of mistakes than when bought *in bulk* from grocery stores.

When carefully selected seed of proper varieties is planted under correct conditions, we may be reasonably sure of a profitable crop, while if any one of these considerations is neglected the result may fail to yield a profit and perhaps may not even return the value of the labor bestowed upon it.

BREEDING AND SELECTION OF SEEDS.

BY CHARLES S. CRANDALL, M. S.

Read at the Brooklyn Institute, February 15, 1889.

It is our fortune to live in an age of most wonderful progress. Great discoveries have followed each other in close succession. Industrial life has been revolutionized in a short half-century, and this rapid revolution has had its effect upon all people; no walk in life has been beyond its influence.

Originating primarily in new applications of steam and electricity which gave rise to new processes and mechanical contrivances, it affected first one industry, then another, then another, until the whole fabric was changed.

The change was of necessity wide spread, because of the intimate relations and inter dependence of all the varied branches of industry. These industrial changes have multiplied the number of products, they have multiplied the quantity, and through improved transportation facilities these products are given access to the great markets of the world.

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COMPETITION.

The natural result of this is competition, and to such an extent has competition increased that it is today the most efficient spur to business activity. It had revolutionized business methods, necessitated the introduction of comprehensive systems of management in every branch; with an attention to small details never before thought of. Attention has been turned to waste products, and in many instances the utilization of these waste products returns the sole profit of the business.

The systems of business in manufacturing and commercial houses are marvelous in their completeness, and on the maintenance of these perfect systems which regard no detail as too small to receive attention does success depend. Competition in all the products of the farm is active, and it exerts the same tendency toward low prices that is shown in other industries. Its influence is all-pervading, and can not be evaded. Now what is the effect of sharp competition upon the manufacturer? Is he discouraged, ready to sit down and give up? Not at all. It spurs him into activity to produce a better article or to lessen cost of his present product.

The farmers of Michigan may draw a useful lesson from the manufacturer. Do not let low prices act as a discouragement, but as an incentive to the production of larger crops of better quality. The farmer cannot afford to sit down, content with what he has done, and, Micawber-like, wait for something to turn up. Competition, which has brought prices down, will prevent any great fluctuation, unless in the event of some great social or political upheaval, and this we have no reason to expect. The remedy lies in the direction of the better development or improvement of farm methods, the introduction of business principles, in the bringing of all the varied farm operations under a comprehensive system, which will secure the same attention to details that is so potent a factor in the success of the manufacturer.

The directions in which improvements in farm operations can be made are numerous; it is not my purpose to enumerate them, but to call your attention to one line, in which there seems to me to be great possibilities.

THE SELECTION AND BREEDING OF FARM SEEDS.

The question of seed is one that must recur to every farmer as the seasons roll round. It is an important one, and it does not seem to have received that attention which its importance demands. A great deal of money has been expended in improving breeds of cattle, horses, sheep and swine. Seedsmen, nurserymen and florists have spared neither labor nor money in the breeding and improvement of vegetables, fruits and flowers, but the improvement of farm crops through attention to the seed has been neglected. Experiments have been conducted that have clearly shown what could be done in this direction, but no systematic effort has been persisted in. That some farmers do take considerable pains with their seed, that some even practice selection, I do not doubt; but I do not believe the practice to be general, or we would see better crops, and the averages per acre would certainly be higher. From all I can learn from inquiry and observation, the general practice of seed saving is careless in the extreme, and tends constantly toward the deterioration of those qualities which make

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new varieties at first so valuable. The quality of the seed will make a wide difference, not only in the quantity, but in the quality of any crop. Seed should not only be good in possessing the power to germinate, for germination by no means insures perfect development, but it should possess the vigor and vitality to give the plant such a start that it may overcome any existing injurious influences, and grow on in full strength to complete development, imparting its own strength to its offspring. A seed may germinate, and yet result in a weak, sickly plant that will give no profitable return, and not only that, but pollen from such a weak plant may convey a degenerating influence to the progeny of neighboring plants that are themselves vigorous. In order that seed may have this necessary vitality, it must have backing—the backing of vigorous parents, and if this vigor has descended to it through several generations of equally strong ancestors, so much the better.

The general law that like produces like is as applicable to plants as to animals. Now, in the common practice of seed sowing what are the chances of securing and preserving from season to season those qualities which are most desirable; qualities which best insure profitable returns—vigor and productiveness, together with that form, size, color and chemical composition of product which is most profitable in any particular market. A farmer at seeding time goes to his wheat bin, screens out the required number of bushels of large berries, and is satisfied that he is sowing good seed. A large seed is not necessarily a good seed; size is a good quality, but it should not govern alone. Large seeds may, and are very likely to come from very short heads; they may come from heads that bore a half dozen large berries and the balance very small ones. They may come from a plant producing few heads, or from a plant possessing small vitality. A large seed may have come from a perfect mother, and still have rolled up in its coats the influence of a sterile or unproductive father. Then here is another point worth considering. Occasionally, through unfavorable atmospheric conditions, extreme drought or excess of rain, a whole crop will lack vitality and be imperfectly developed. Seed from such a crop, if it grow at all, may produce but an inferior crop the next year, no matter how favorable the season.

Prof. Tracy tells of visiting, a few years ago, forty wheat fields in the neighborhood of Detroit. Thirty-eight of them were poor. Two were good, and he found upon inquiry that on these two fields seed a year old had been used, while on the others seed from the previous crop had been used, and this crop was known to have possessed very little vitality. Similar observations in other portions of the State gave the same results.

We frequently hear complaints that certain varieties have run out; a variety of wheat for instance, that when first introduced was perfectly hardy, had good stiff straw, and gave a large yield of fine plump berries, has gradually lost these qualities, is no more profitable, and farmers are casting about for a new variety to take its place. Is it at all strange that under the common practice this deterioration has taken place? Let us notice for a moment a few principles that apply to all plant life. All plants, and especially all cultivated plants, have a certain susceptibility to variation. They vary as the conditions of the soil, season and climate to which they are subjected vary. Crossing between individuals of the same variety that possess different characters will increase the tendency to vary. Crossing between

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varieties, or hybridizing between species will make the tendency still more apparent. In short, the greater the diversity between these characters in parents, or in more remote ancestors, the greater will be the tendency of the offspring to variation. The offspring of a crossed plant may show the character of either parent, of both parents, or of neither; it may by reversion or atavism exhibit the preponderant character of great-grandparents or of still more remote ancestors. On the other hand the offspring of plants that have been bred in and in for several generations, where the parents have been selected for similarity of characters, tend to reproduce the characters of the parents, and where this is persisted in for a long enough time, the characters become fixed, and are reproduced in each succeeding generation.

Now, our most valuable cultivated plants have been developed in particular directions; in the direction of certain characters which made them valuable to man. High cultivation and constant selection have changed them greatly from the wild types. The valuable characters have become abnormal, and it is in these abnormal characters that we have exhibited the tendency to variation.

Plants cultivated for their seeds show little or no tendency to variation in foliage, and plants cultivated for their leaves do not vary in the direction of the seed they produce. All of our particularly fine varieties of wheat, corn, oats, potatoes, cabbage and other vegetables have reached their present state of perfection, not by accident, but by careful and intelligent design. The originators may have started with a cross or a hybrid, followed up by careful selection, or they may have commenced by selection alone, and persisted in it until the ideal type was reached.

The more perfect, in our eyes, these varieties are, the more abnormal they are, the farther are they removed from the original type; and the greater the abnormal development, the greater is the tendency to atavism, or reversion to the original from which they have descended. Hence the necessity of constant care in order that the high development reached may be maintained and perpetuated in succeeding generations. In the ordinary farm practice this care is not exercised, and deterioration, the natural result of relaxed care, follows. That we may understand something of what has been accomplished in the improvement of varieties by selection of seed, I wish to notice briefly two or three well authenticated instances: Taking first the experiments of Mr. Hallet, of Brighton, England.

HALLET PEDIGREE WHEAT.

The "Hallet Pedigree Wheat" has become matter of history. His experiments have been quoted again and again in agricultural books and journals. To many of you they may be familiar, but for the benefit of any who may not be acquainted with them, I desire to review his work and the conclusions he reached:

From a study of the principles of selection as applied to the breeding of animals, Mr. Hallet became convinced that the same principles could be applied to plants. Of wheat he observes that "starting with an accidentally large ear is a very different thing from starting with a similar ear the result of descent or pedigree. Take the case of two heifers, identical in every respect but pedigree. The one what she is by accident, the other by design. From the former you may get any imaginable kind of progeny, from the

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other only a good kind. In other words, you have fixity of type; and the good qualities gain the force, as it were, of impetus, by continual accumulation."

Having proved to himself, by his earlier experiments, that accidentally large ears were not the best to start with, he began by choosing the then best known variety of red wheat, called the Nursery wheat.

In a field seeded with two bushels to the acre, and treated in the usual way, he planted a number of grains singly, so that they had room for full development; from the best stools grown from these seeds he selected his two original ears. These ears were chosen, not with reference to their size, but with reference to the quality of the grains they contained.

The number of grains in the two heads was 87. One contained 47, the other 40. These were sown in rows 12 inches apart, each head having a row to itself. The grains were placed singly 12 inches apart. From this sowing the finest grain produced ten ears, the best one containing 79 grains. From the second sowing the best grain from the ear containing 79 grains produced a stool with 22 ears, and the best ear contained 91 grains. The next year the heads were imperfect owing to bad weather, but the best stool had 39 ears. The fourth year one grain produced a plant having 52 ears. Another grain produced a plant having 24 ears, and the best ear from this stool contained 123 grains.

Year.		Length. Inches.	Containing grains.	Number of ears on finest stool.
1857	Original ear	4¾	47	----------
1858.	Finest ear	6¾	79	10
1859.	Finest ear	7¾	91	22
1860.	Ears imperfect from wet season	----------	----------	39
1861.	Finest ear	8¾	123	62

"Thus," says Mr. Hallet, "by means of repeated selection alone the length of the ears has been doubled; their contents nearly trebled, and the tillering power of the seed increased five fold." From his 20 years' experience in experimenting with wheat, oats and barley, Mr. Hallet draws the following conclusions:

That on every plant there is one ear which has greater productive power than any other ear on that plant. That there is one grain contained in the best ear of every plant that is more productive than any other grain of that ear, or of the whole plant. That by repeated selection the superiority is accumulated. That there is a limit to improvement, and that a high degree of development can be maintained by continued selection.

THIN SEEDING.

In an experiment to ascertain the comparative number of ears on an acre seeded thickly and on one seeded thinly, he drilled in the ordinary manner, on one piece one and one-half bushels to the acre, on another he dibbled in the seed, using four and one-half *pints* to the acre. On the drilled piece he

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estimated 934,120 ears to the acre, and the yield was 54 bushels per acre. The estimated number of heads on the dibbled acre was 1,001,880, or 67,760 more than on the drilled piece. The amount of seed used on the drilled piece being more than 21 times that used on the dibbled piece. Pedigree seed was used in both cases.

In a trial on large areas, he grew on ten acres of his *poorest* wheat land, from one peck of seed per acre, the grains planted singly, 57 bushels per acre of grain, and 45 hundred weight of straw; and on eight acres of his *best* wheat land, from one and one-half bushels of seed per acre, drilled in the usual manner, he obtained 54 bushels of grain and 36 hundred weight of straw per acre.

There appears two factors in Mr. Hallet's method of thin seeding that supplement and greatly add to the benefits accruing from repeated selection, namely, giving each plant plenty of room for full development and good cultivation; for where his plants were grown 12x12 inches apart, or 9x9 inches apart, they were given the same culture that would be given a root crop.

But on those pieces where the common practice was followed, drilling one and one-half bushels of seed to the acre, we can see the benefits of repeated selection alone. These gave from the pedigree seed 54 bushels per acre, while the yield from his ordinary seed was only 36 bushels per acre.

Backed by the facts accumulated from his experiments, Mr. Hallet made a strong plea for thin seeding. His method and the results of his experiments were discussed pro and con before all the agricultural societies and clubs in the kingdom. A good many farmers gave his method a trial. Some phenomenal crops were reported, and some complete failures. Messrs. Lawes & Gilbert took up one plan of thin seeding and after a four years' trial pronounced it a failure on Rothamstead soil. In their summing up of the experiment they remark: "We think, therefore, that considerable caution should be exercised in the application to various descriptions of land, of plans which peculiarly rely for their success on qualities of soil which are admittedly so variable in the degree of their activity." Thin seeding was not generally adopted because of its uncertainty. On certain soils, with all conditions favorable, the crops were good, on other soils, and particularly on heavy soils, failure was the rule. But wherever the pedigree seed was used with the ordinary method of seeding, large increase of yield was invariably reported.

The advantages of selection were abundantly proved.

CROSSING.

By following Mr. Hallet's plan of selection we can render more permanent any good qualities a variety may possess, and the yield may be greatly increased. But when it becomes desirable to change the character of a variety, or of its fruit, to add new qualities, or to combine qualities which exist in different varieties, we must resort to crossing. With the florist and vegetable gardener this practice has been rapidly extending, and its use has resulted in a wonderful improvement in varieties, but its application to the improvement of farm crops has as yet been very limited. The earliest recorded attempt at crossing wheat that I am able to find is that made by Mr. Knight, about the year 1790. He did not perform the operation of

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crossing artificially, but having selected the two varieties he wished to combine he sowed them together, and then selected those heads which exhibited the combined character of both parents. These selected varieties were propagated separately. They showed great improvement over the parents in both yield and quality. In the years 1795 and 1796, when nearly the whole crop in England was destroyed by blight, these crossed varieties, wherever sown, escaped and produced large crops. In 1846 Mr. Maund exhibited before the English Agricultural Society some wheat, the result of a cross he had made. He performed the crossing with his own hands, taking the necessary precautions against foreign pollen, so that he knew positively the parentage of his sample. He also exhibited samples of both parents so that comparisons could be made. His crossed variety was an advance over the varieties then in use in that it gave increased yield, and the quality was of the best.

In 1852 Mr. Raynbird placed on the market an even sample of a crossed wheat, which proved another great acquisition. He obtained it in this way. In 1846 he grew a small quantity of "Piper's Thickset," a very prolific variety, but having a short head and short straw, and being subject to blight. He supplied flowers of this variety with pollen from the "Hopetown," a very fine white wheat having long straw. The product of the cross he sowed and selected from until the qualities that appeared most desirable became fixed.

In our own country we have the work of Prof. Blount, of the Agricultural College of Colorado, who has for ten years given special attention to the production of new varieties by selection and crossing. He writes me that he now has 369 varieties of wheat, 52 of oats, 31 of barley, 20 of rye and 150 of corn, the seed of which he has procured from all over the world.

In growing these varieties he selects each year the best heads from the first ripe plants. He says, "I have made a specialty of crossing and selecting wheat to make better varieties for both farmers and millers."

In crossing he selects plants having stiff straw and compact heads for the mother plants, and takes pollen from varieties that are not too widely different from the mother plants, always choosing carefully with regard to the particular characters he would have represented in his ideal variety.

To quote again: "I have made over 40 crosses, 10 of which are very much finer in every way than either parent. Some of them are absolutely rust proof; obtaining new varieties by crossing and selection had added much to our reputation as a wheat growing State. At New Orleans our grain took first premium, and sweepstakes over everybody. Our wheat now stands first in the world for milling properties." The improved varieties originated by Prof. Blount are now grown all over his State, and in States adjoining, and the benefits accruing to the farmers through their use have been very great.

CROSSING INDIAN CORN.

I have referred thus far only to the selection and crossing of wheat. Our Indian corn is capable of improvement in the same manner. There is the same certainty of a large return from a small amount of labor devoted to selecting and saving the seed. Very many farmers who are particular about the date of planting, and who will let nothing interfere with the cul-

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tivation, seem to forget that the foundation of a good crop is good seed, and pay no attention to its selection.

There is no food plant more pliable, more readily varied in any given direction under intelligent and well directed care than the corn plant. It adapts itself to a wide range of climate. It will grow on all kinds of soil. It is at the same time very sensitive to surrounding influences, and its productiveness depends upon soil, season, and the treatment it receives. Recorded experiments in the selection and crossing of corn for seed are numerous, and in no case do they fail to show the great advantage to be derived from care thus bestowed.

Prolific seed of good pedigree has produced from 100 to 160 bushels per acre under ordinary treatment. There is an authentic record of 200 bushels and 12 quarts raised on one acre, the result of good seed, high fertility and good cultivation. This was a phenomenal yield; it shows, however, what can be done by persistent effort. Yields of from 100 to 150 bushels per acre are not phenomenal, they have been too often produced. The wonder is that the frequency of these results has not created a more widespread desire to equal or excel them; perhaps the desire has existed, but the inclination has not given way to it, or perhaps there has been a fear that a systematic practice of seed selection and breeding would involve too much work. Of course such a system involves additional labor, but results obtained show that it can well be afforded. Nature does not pour out her richest gifts or reveal her secrets unasked, she may, and does in her freaks, as we call them, hold out tempting baits, and these are to the intelligent observer, invitations which he is glad to accept. She is ever ready to extend aid, and he who essays the improvement of his crops through the honest application of the principles of reproductive life, need have no fear that his efforts will not be rewarded.

There are several things that need consideration in the selection of seed corn; manifestly the size of the ear, the shape and quality of the grain are not the characters solely to be depended upon when looking toward perfection in the crop. They are in themselves good points—important points—but the first consideration should be the character of the plant itself. Its prolificacy—an all important point—its vigor and habit of growth, position of the ears, and time of ripening.

Having selected the plants that best show these characters, from them take the best ears, not necessarily the largest, but those that in shape, quality of grain and size of cob, come nearest to your ideal of a perfect ear. The characters of the ear and grain are more easily varied than are the characters of the plant itself, and for this reason they should when commencing a systematic selection be considered as of secondary importance. There is another point, which, if left out of our calculations, would continually tend to nullify all our efforts at improvement through attention to the characters we have named. The corn plant as you know is monœcious, that is, the two sexes are borne in separate flowers on the same plant. In the silk as it is called, we have the long styles of the fertile flowers which project from the young ear. In the tassels we have the sterile, pollen producing male flowers. Now, in looking through a corn field we find a good many stalks that produce pollen freely, but bear no ears. Pollen from these sterile plants will fertilize ears on some of the fertile plants. These ears then have as parents a fertile mother, and a sterile father, and under

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the law that "like produces like," the sterile father exerts an influence tending to the production from the offspring of plants like himself—sterile.

I believe that this influence of sterile males has more to do with the decrease in product of a variety at first prolific than any other one cause.

There is but one way to eradicate this evil, and that is to go through the corn at blossoming time and remove the tassels from all plants bearing no ears, before the shedding of pollen commences. We can thus insure the transmission of a tendency to productiveness from both parents, and having done this, we can look forward to a certain reward for our attention to the other details.

AN AVERAGE BUSHEL OF CORN.

In order to make an approximate estimate of the degree of barrenness in an average cornfield, and to possess myself of a tangible starting point for a comparison of what we harvest, and what, by due attention to the seed, we ought to harvest, I obtained from a farmer a basket of corn on the cob. It was taken from the top of a well sheltered crib (January 5, 1889), and was a fair sample of the crop from an 18 acre field, which measured out 82 baskets or 41 bushels of shelled corn to the acre, a yield rather above the average as indicated in the State farm statistics for the year 1886, which give an average for the State of 29.1 bushels, and for Jackson county of 35.3 bushels.

My sample weighed exactly 35 pounds—one-half bushel. I counted the ears, and divided them, according to their appearance, into three classes. There were of fair ears, 13; of medium ears, 56; of poor ears and nubbins, 39; 108 in all. There was not a really good ear in the lot, none that I would care to use as seed. The color varied greatly; the kernels varied in shape all the way from narrow and deeply dented, to the broad rounded ones, characteristic of the flint varieties. The number of rows of kernels varied from 8 to 20. It was very evident that no attempt to breed to a type or to keep a variety pure had, in this case, been made. Taking each ear by itself, I weighed it, ascertained the weight of grain, the weight of cob, the length, and the number of rows of kernels. The results were tabulated, and from them I have drawn certain averages. The average weight of grain to the ear in the three classes was: For the 13 fair ears, 6.08 ounces; for the 56 medium ears, 4.22 ounces; and for the poor ears, 2.34 ounces. These averages are quite low. The New York Experiment Station, from many trials, takes seven ounces as an average. This is nearly an ounce more than the average of our 13 best ears, and nearly double the average of our total of 108 ears, which is 3.77 ounces.

BARREN CORN STALKS.

Now let us examine the degree of prolificacy as indicated by our sample. Doubling the number of ears in each class, and multiplying by 41, the yield in bushels per acre, we have as the product of one acre 1,066 fair ears, 4,592 medium ears and 3,196 poor ears, or a total of 8,856 ears. The corn was planted 4x4 feet and averaged four stalks to the hill, giving us 10,890 stalks on an acre.

Now suppose we allow one ear to a stalk; you will observe that we have not enough ears to go round, but have left 2,034 stalks, or 18 per cent, that

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bear nothing at all. Observe too, that we have 3,198 ears, or 30 per cent, yielding only 2.34 ounces of grain each; these ears are unmarketable and certainly unprofitable. Add our barren stalks and these last unproductive ones, and we have 5,227 stalks, or 48 per cent, that are practically of no value. Consider, too, that as matter of fact a good many stalks produced two ears each, and we will raise our percentage of unproductive stalks much higher. Now, let us suppose that this farmer, by judicious selection, raises the quality of ears produced to that of the 13 fair ears in our sample, or to an average of 6.08 ounces of corn to each ear, his yield would then be 60 bushels per acre, an increase of 46 per cent. Suppose he should improve a little further, and make each ear equal to the best ear of our sample, which carried seven and one-half ounces of grain; then he will harvest 74 bushels per acre, a gain of 80½ per cent over the present crop of 41 bushels; but this is with no increase in the number of ears. Now, we will suppose that we have bred out the barren stalks, and that each one of 10,890 stalks produces one ear that yields seven ounces of grain, and we have a yield of 85 bushels per acre, or an increase of 107 per cent. In breeding out our barren stalks we have at the same time been selecting towards more ears to the stalk, and we may fairly suppose that one-half our stalks will yield two ears each, and this with each stalk of the other half producing one ear would give us 127½ bushels of shelled corn to the acre. These suppositions are not exaggerations, they are within the range of probability, because within the range of what has already been accomplished. These same results can be realized on every farm in Jackson county.

It is a demonstrated fact that in seed selection and breeding lies as important a factor as any concerned in the prduction of profitable crops. Thorough cultivation and high fertility are also important factors, but alone, they cannot accomplish the best results. There is a limit to the profitable application of manure and of labor in the growing of any crop; beyond a certain point every bushel added to a crop by these means costs more than it is worth. It costs no more to care for a good crop than for a poor one. The foundation of a good crop is good seed. Therefore, the farmer who would have the best possible crops, who would have the most profitable returns for his labor and care, must consider all of the elements of success, and give to each factor its due share of attention.

HOW TO CROSS INDIAN CORN.

The cross-fertilization of varieties of corn is easily accomplished. The sexes being borne separately, that delicate manipulation required in crossing hermaphrodite flowers of such small size as are those borne by the wheat plant is not necessary.

To cross two varieties, and be sure the cross is in the direction you wish, pure seed of the varieties should be planted in contiguous rows, or, if in quantity, in alternate rows, far enough removed from other corn to prevent contamination from foreign pollen. As soon as flowering commences all staminate flowers must be removed from the mother plants; this insures the fertilization by pollen from the other variety which you have chosen for the male parent. In choosing varieties to be crossed it is not best to use those that present too great differences. Thus, no probable good would be derived from crossing dent with flint corn—because characters so widely dif-

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ferent would tend to great variability. The fixed characters of the parents would be very unstable in the offspring, and all attempts to breed toward a fixed type would be interfered with by the tendency to reversion.

Hence, varieties for crossing should differ only in minor characters. Then we may expect stability of character in the progeny, and that additional vigor and productiveness which is the aim of crossing.

CHANGING SEED.

Experiments have shown that the crossing of plants of the same variety which have been grown under different conditions, will yield as good if not better results than crosses between distinct varieties. Mr. Darwin, in his admirable work, "Cross and Self-fertilization in the Vegetable Kingdom," remarks on this point: "That the advantages of cross-fertilization do not follow from some mysterious virtue in the mere union of two distinct individuals, but from such individuals having been subjected during previous generations to different conditions, or to their having varied in a manner commonly called spontaneous, so that in either case their sexual elements have been in some degree differentiated."

It is a very common practice with gardeners to obtain, at intervals, an entirely new stock of the seed of certain plants from a distance. Their crops of these plants when grown from the same stock, under the same conditions, constantly diminish in spite of careful attention to seed selection and cultivation. It is said that the onion growers of Connecticut, who import their seeds from Tripoli, are obliged to renew their stock every three or four years. The deterioration in this case follows undoubtedly from conditions of soil and climate.

Farmers often resort to this same plan of changing their seed corn and seed wheat. Mr. Darwin suggests as a better plan, to obtain some seed of the same variety which has been grown under different conditions, and plant it with your own. "The two stocks would then intercross with a thorough blending of their whole organizations, and with no loss of purity to the variety, and this would yield far more favorable results than a mere exchange of seeds." His careful experiments abundantly prove that wonderful results are to be obtained from crosses of this kind.

Dr. Beal, at the College, obtained two kinds of corn, nearly or quite alike, from two localities, crossed them and planted the crossed seed in a field of dent corn. The yield from the crossed seed excelled that from the corn not crossed as 153 exceeds 100. On farms where the soil is various in character, an effect equivalent to change of seed or change of condition is brought about by growing the crop each year on a different soil.

CLOSE BREEDING.

In connection with the question of changing seed arises the question of close breeding. How long will a variety maintain its vigor if grown year after year from the same stock, with no admixture of new blood? Crossing between neighboring plants continually occurs in fields of corn, and to some extent in fields of wheat. It is more general in corn than in wheat because the flowers of wheat are constructed to aid self-fertilization. But many

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plants are self-fertilized, and all the crosses are between near relations, because all spring from the same stock.

Tessier in France, and Col. LeCouteur in Jersey, have both made elaborate experiments to ascertain if any evil effects arose from this close breeding. Both reach the same conclusion, namely, that with care given to the selection of seed no decrease in vigor or productiveness results, even after a term of years. LeCouteur recommends, however, a rotation of manures and a change of soil, if possible within the limits of the farm.

Mr. Darwin is very positive in his statement that self-fertilization is injurious. But he adds, "Whether the evil from self-fertilization goes on increasing during successive generations is not as yet known, but we may infer from my experiments that the increase if any is far from rapid." He attributes the maintenance of vigor in those cases where plants have been grown for a long time from the same stock, to a previous cross, the effect of which has been transmitted through all the generations.

The subject of close breeding in plants needs further investigation before definite law can be laid down, but practical experience seems to indicate that with all farm crops it can be carried on indefinitely without injurious effects provided due attention is given to seed selection. Some writers maintain that grain crops are bound to deteriorate unless the seed is frequently changed. Their assertions are based upon the facts that varieties do under common treatment deteriorate, and that change of seed has proved of benefit.

They generalize from insufficient data, and without the support of experiments. We now have abundant evidence that varieties can be maintained and even improved by due care in saving seed, and when a farmer has varieties well suited to his soil and climate, his safest plan is to adopt a systematic selection of seed, and thus breed up strains that answer all his requirements.

CLIMATIC LIMITATIONS.

There are however cases where change of seed is desirable or even necessary. They arise from climatic influences. Climate, as you know, limits the range of dent corn. Southern dent corn when taken north, if planted within limits that will allow its ripening enough for seed, will rapidly change its character; the stalk becomes shorter, the kernel loses the dent and becomes rounded, it ripens earlier, and in a very few years it is transformed into a variety resembling the native corn in all respects. On the other hand the eight rowed flint corn if removed south will transform itself into dent. Now, there are localities in our State, lying on the border between the natural homes of flint corn and dent corn, where the dent corn is the more profitable of the two, but under the influence of climate it gradually loses the characters that distinguish it, and it becomes necessary every three or four years to obtain fresh stocks of seed from the more southern counties. This is the practice of many farmers of Kent and other counties having similar ranges of temperature.

The oat plant delights in a cool, moist atmosphere. At the north it yields larger crops, weighing more pounds to the bushel than it does south, and seed of these northern oats taken south, will the first year yield more and heavier oats than those from native seed. The second year there is a falling off, and soon they will be no better than the old stock. Hence the practice in many localities of obtaining seed oats from higher latitudes.

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With all our cultivated plants, the line of most profitable production is somewhere within the native region of the plants. These native regions have their limits, outside of which the plants cannot be cultivated with profit. The beet sugar industry of France and Germany offers a good illustration. There is a line north of which the industry cannot be carried on, because the per cent of sugar becomes too low to pay the cost of extraction.

Whenever it becomes necessary for a farmer to procure seed from abroad, it is of great importance that he should know under what climatic conditions the seed was grown; he ought also to know the character of the soil. Then he can avoid the costly error of getting something entirely unsuited to the demands of his particular locality.

SEED DEALERS.

Here lies the difficulty in obtaining seed from seedsmen. The varieties they offer are highly praised, and the farmer is tempted by the examples of wonderful productiveness which they give. We have no reason to doubt the correctness of these examples, but we may fairly doubt the possibility of obtaining the same results under a different climate and on different soils. If the seedsman can furnish the details of soil and climate under which the seed was grown, so that you can compare it with your own, you can then judge of its value to you. If he cannot do this it is not safe to use his seed. Some seedsmen give the matter of climate due attention, others do not. One catalogue contains a tempting description of a variety of corn, the seed of which all comes from northern Vermont, and it is recommended for all parts of the United States.

For the farmers of southern Michigan the means of seed improvement do not lie in the direction of changing, but rather in the line of selecting and breeding your seeds on your own farms, after the methods I have attempted to outline. As to the particular varieties upon which to begin a systematic improvement, each farmer should be guided by his experience of what is best suited to his particular climate, his soil and his special purposes. Let him establish in his mind an ideal, and starting with the best he can procure, work toward it. A definite purpose, kept constantly in view, is the best incentive one can have. It will render efficient aid in the breeding of seed as in any other work.

FASHION IN VARIETIES.

Fashion, at times, rules on the the farm, as it does in the dressmaking establishment. It is not a good guide to the selection of varieties, and to follow it is often costly. Mr. A. obtains a new variety of wheat, which, on first sowing, does well; next year Mr. B. must have some. In three years everybody in the neighborhood has tried it. In five years more no one grows it. Under certain conditions on certain soils it may have done well; under other conditions on other soils it failed, and those who tried it were the losers.

New varieties are without number, and they incline us to neglect old ones. Substituting the new for the old is not advancement. We advance when we can keep the old varieties in all their purity and vigor, and then originate new ones as good or better. Every farmer should take pride in not

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allowing a good variety to degenerate on his hands. He should continually tax his ingenuity in trying to improve what he has.

Mr. ——: Will every kernel on the same ear produce the same kind of corn?

Mr. Crandall: No; the different kernels may be fertilized by different pollen, and so produce offspring of great variety.

Mr. ——: How do such kernels come, then?

Mr. Crandall: Each line of silk projecting from the ear is the pistil of a separate ovule, and each grain of pollen coming from the tassels fertilizes that kernel only on whose line of silk it falls.

Mr. ——: How can wheat be crossed?

Mr. Crandall: It is a difficult matter, and can only be done by the utmost care and with a magnifying glass.

Mr. ——: I think we all want to improve our seed; but few know how. I tried crossing two varieties of corn, that differed three weeks in earliness, and cut off the tassels from the large variety, and on that variety I had not even a nubbin of corn.

Mr. Crandall: The silk can only be fertilized during about one week, and by removing the tassels from the one variety the tassels of the other were not on hand at the right time.

PRACTICAL FARMING.

BY J. D. REED OF COLUMBIA.

Taken from report of the Brooklyn Institute by the Manchester Enterprise.

MR. PRESIDENT, LADIES AND GENTLEMEN:

With differing men, soils and seasons, it is difficult to lay down any rule for all. Experience is the best teacher. If, as is said, farming is at the foundation of all business, it is important that we be successful. Let us stand by our business, praise it, boom it; not always look on the dark side. To be practical is to practice what we believe. If you think farming a poor business, let everything run down, don't look after details and you will soon be poor enough. If you think a farmer must be a numbskull, don't read, don't reflect, don't seek to rise. Mixed farming is best. Beans are a profitable crop. My rotations are something as follows: 1st. Meadow or pasture. 2d. Corn. 3d. Oats or beans, followed by wheat and seeded to clover and timothy.

Another is: 1st. Meadow or pasture. 2d. Beans, followed by wheat, then stubbled to wheat again and seeded; but oftentimes the drought is so severe that we loose our seeding. In such a case we must do the best we can. In practicing economy, house your tools; if you cannot house them, pile them up behind your barn rather than in front.

Farming is progressive. In 1350 the skilled laborer in England gave 112 hours labor for a bushel of wheat; in 1550 the same kind of a laborer gave 80 hours for a bushel of wheat; in 1795 he gave 70 hours; today the skilled farm laborer can get a bushel of wheat for about 12 hours labor.

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Let us hope that practical farmers will more and more carry their improvements into their homes, and learn that of all things they cultivate they are themselves most susceptible of cultivation.

Discussion on Farm Book-keeping.

Mr. W. Pierce urged a system of book-keeping by which the farmer may know just what each article costs. Prof. Carpenter asked how to keep such a system of books. Has made the effort, but has been unable to succeed. The farm costs so much and brings in so much, and that is all he knows about it. L. D. Watkins has also made the attempt; purchased a farmers' account book and set out in good faith, but failed. There are so many obstacles in the way he believes it impossible.

H. G. Reynolds: It is easy to say that the farmer ought to know to a cent what his crops cost him, but it is an extremely complicated thing to get at, particularly in farming on a small scale and on the plan of mixed husbandry, where the labor is largely performed by the farmer himself, his wife and his children, and where so large a proportion of the labor partakes of the character of chores. What is the cost of a pig fed on the house swill and cared for by children's choring? Do you say the cost is nothing? That is an easy answer, but it is not book-keeping. But a book-keeping answer to that question, of sufficient accuracy to be of any value, is almost an impossibility; and in the style of farming of which I speak, which is the style of most of the farming throughout the country, there is so large an element of these things which cannot be reduced to figures that the would-be keeper of farm accounts soon finds himself driven to omitting a good many things and guessing at a good many others.

Take that prime element in the cost of producing any farm crop—the manure. Unless you buy it of some one else at so much per ton, load or cord, what is left for you but to guess at its cost, or to estimate its value at what you or some one else once paid for it somewhere else? Why not as well guess at the cost or value of your finished crop at once and be done with it? or why not simply say that on some other farm, or at some other time, such a crop sold for so much, or was reckoned to have cost so much, and therefore you will take that figure for your present case?

That is also easy, but it is not finding out the cost of your crops by book-keeping.

A. Hitchcock: I have tried to keep books in farming, and found that there was inevitably too much of estimating to make the book-keeping of value. Manure lasts beyond the first crop, but in what proportion no man can tell.

T. B. Halliday: I have found the greatest difficulty in accounts in estimating the proportion of manure used by succeeding crops. I have little trouble to determine nearly the cost of the labor applied to field crops, and find my accounts a source of satisfaction if not of profit.

Mr. Holmes: Mr. Pierce's idea seems to me impracticable, because of the variability of prices to be obtained.

Mr. ———: What proportion of manure would Mr. Halliday charge to a crop?

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Mr. Halliday: I can't tell. Last year manured land had poorer corn than unmanured. Where the corn crop is good I charge one-third of the manure to it.

D. C. Blair: Book-keeping for farmers seems at a discount, but I have been much interested in figures that have emanated from the Agricultural College and Experimental Station, resulting from book-keeping. I believe that such work should be continued.

Mr. Watkins: There is no objection to farmers keeping books. They should do so, and should yearly take inventories; but there is no possibility of keeping the perfect account with fields that is sometimes proposed.

President Willits: I wish every farmer would keep for one year, if no more, a correct account of the value of every article he uses that comes from the farm, and that he does not have to buy, but that village and city folks do. They would think more favorably of the profits of farming than they do now.

WHEAT PRODUCTION.

BY GEO. W. OSBORN, OF MENDON.

Read at the Farmers' Institute at Centreville, Feb. 19, 1889.

MR. PRESIDENT, LADIES AND GENTLEMEN:

Why is the price of wheat so low, and how can we make it profitable to raise it? The price of wheat, as well as of all other commodities, is governed by the universal law of supply and demand. A large surplus of any commodity results in low prices and a stagnant market. Monetary influences also largely affect prices; if money is plenty and cheap, prices are higher than when it is scarce, although other conditions of supply and demand remain the same. Are the low prices of wheat due to over production, or, in other words, is there more wheat produced in the world than is required for consumption.

In 1875, according to the report of the Commissioner of Agriculture, Michigan produced 16,870,000 bushels of wheat from 1,249,629 acres. In 1887, 12 years later, we produced 21,672,000 bushels from 1,629,467 acres, an increase of 4,802,000 and 379,838 acres. The average price per bushel during this period has ranged as follows:

1875	$1 15	1880	$0 97	1884	$0 74
1876	1 16	1881	1 25	1885	84
1877	1 22	1882	90	1886	73
1878	85	1883	96	1887	74
1879	1 17				

Thus it will be seen that the prices since 1881 have been uniformly low, averaging 82 cents per bushel. During which time the volume of money in circulation has decreased, and the production of wheat has increased, as will be shown by a comparison of the world's production and consumption for the same period. Unfavorable climatic influences for the past two years, damage by the Hessian fly in central southern Michigan, and low prices have made the wheat crop an unprofitable one for the farmers. But the past two seasons have been beneficial for the future raising of wheat, by reducing the

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numbers of the Hessian fly, and I predict that they will do very little damage in this locality for two or three years, unless they come here from some locality where the conditions have been more favorable for their increase. The area of greatest wheat production in the United States is moving with rapid strides to the west and northwest, while the production in the east remains about the same. In 1849 half the crop was produced on the Atlantic coast and eastern slopes of the Alleghanies. In 1884 half the crop was grown beyond the Mississippi, and only one-eighth on the Atlantic coast.

The westward movement of wheat production is shown by the following table:

Number of Millions of Bushels of Wheat Raised per Year for Successive Periods in Different Sections of the United States.

Year.	East of the Alleghanies.	Between the Alleghanies and the Mississippi.	West of the Mississippi.	Total.
1849	51	43	5	99
1859	53	94	25	172
1869	54	143	89	286
1879	58	229	171	458
1884	62	185	264	511

During this period the wheat acreage of the United States increased from eight millions of acres to thirty-nine millions. The world's production of wheat has not only kept pace with consumption but has recently been in excess. In the United States, the acreage of excess over the home requirements is over ten millions of acres at the present time, and is an excess much larger than the surplus acreage of all other countries combined, outside of Europe.

In 1849 the product was four bushels for each inhabitant; in 1859, five bushels; in 1869, seven and one-half bushels; in 1879, nine bushels; and in 1884, nine and one-half bushels. From 1849 to 1884, a period of 35 years, the increase of population was 141 per cent, while the increase in the production of wheat was over 410 per cent. Wheat growing was stimulated greatly between 1875 and 1880 by failure in crops elsewhere, causing a demand which never existed before and may never exist again. Meantime the world's production of wheat is steadily increasing, depressing prices, furnishing cheap bread to consumers, and little profit to producers, and yet the inquiry is made, why are prices so low? We will take a look at the wheat crop of the world, for the years of 1886 and 1887, as shown by statistics furnished me by the statistician of the Agricultural Department.

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Wheat Crop of Europe.

Countries.	1886. Bushels.	1887. Bushels.	Increase, Bushels.	Decrease, Bushels.
Austria	44,644,090	45,400,000	755,910	.....
Hungary	102,846,419	153,894,076	51,047,657	.....
Belgium	18,514,688	20,000,000	1,485,312	.....
Denmark	4,731,531	4,750,000	18,469	.....
France	304,427,095	311,408,943	6,981,848	.....
Germany	97,973,251	98,000,000	26,749	.....
Great Britain and Ireland	65,285,353	78,567,593	13,282,240	.....
Greece	4,987,250	5,000,000	62,750	.....
Italy	129,412,133	120,124,995	.....	9,287,138
Netherlands	4,987,250	5,000,000	62,750	.....
Portugal	8,228,750	6,000,000	.....	2,228,750
Roumania	22,629,063	24,000,000	1,370,937	.....
Russia	161,599,240	223,945,600	62,346,360	.....
Servia	4,525,813	5,000,000	474,187	.....
Spain	85,988,973	95,000,000	9,011,027	.....
Sweden and Norway	4,081,115	4,600,174	519,059	.....
Switzerland	1,645,750	2,000,000	354,250	.....
Turkey	41,143,750	42,000,000	856,250	.....
Other countries	*567,500	*567,500	.....	.....
Totals	1,108,051,514	1,245,191,381	137,139,867	.....

*In the absence of official or reliable statistics for this year, an average product is given.

Wheat Crop of the World.

Countries.	1886. Bushels.	1887. Bushels.	Increase, Bushels.	Decrease, Bushels.
Europe[1]	1,108,000,000	1,245,000,000	137,000,000	.....
United States[2]	457,000,000	456,000,000	.....	1,000,000
Canada[3]	38,000,000	36,000,000	.....	2,000,000
Mexico[3]	13,000,000	13,000,000	.....	.....
South America	29,000,000	34,000,000	5,000,000	.....
India	258,000,000	239,000,000	.....	19,000,000
Australia[4]	22,000,000	35,000,000	13,000,000	.....
Africa and West Asia[7]	130,000,000	130,000,000	.....	.....
Totals	2,055,000,000	2,188,000,000	133,000,000	.....

[1] Exclusive of Poland, Finland and Bulgaria, which are not reported.
[2] Official reports are annually made only for Ontario, and recently for Manitoba; the aggregates include approximations for the other provinces.
[3] In the absence of annual estimates in Mexico, the figures of the latest census are given.
[4] These figures are mainly official; in South Australia estimates are given for 1880 and for the last three years.
[7] The product east and south of the Mediterranean is somewhat uncertain, and 130,000,000 bushels may be taken as a general average.

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It appears evident from the above statistics, that the production of wheat is rapidly increasing over the demand, the legitimate result of which is lower prices and a stagnant market.

When we take into consideration the vast, undeveloped wheat area of the United States, and its rapid settlement by farmers, it is evident that the wheat production upon these cheap and fertile lands will keep up an average increase of surplus for several years to come. Add to this the increasing production of India and South America, especially the Argentine Republic, where it is said there is an immense area suited to wheat culture which European immigration is rapidly developing, and the outlook for higher prices is not very bright. The total area in crops in the Argentine Republic in 1887 was estimated at 5,262,600 acres, and an increase of 23 per cent in three years. Two million one hundred and twelve thousand six hundred acres were in wheat, producing about 200,000,000 bushels, of which half could be exported. Should imigration continue, wheat culture will be rapidly extended, and much the largest portion of the product be exported.

The requirements of European demand can be better indicated by a statement of the average production and consumption, for a period of years in connection with the latest facts of production and supply. Between 1874 and 1881 the average production of Europe was 1,144,000,000 bushels; the consumption in food and seed 1,312,000,000 bushels. For the next five years the average product was 50,000,000 bushels per year higher. Several years of unusually low yield in Western Europe caused American exportation to run abnormally high, and that extraordinary demand led to an increase of millions of acres of wheat in this country, and a larger area in Russia, India, Australia and South America. A review of these figures shows the fact that nearly all the wheat raising counties of the world aim to produce a full supply, and usually succeed.

And that North America, South America, Asia, Africa and Australasia produce generally a surplus, while Europe produces three and one-half of the four bushels required per capita.

It shows that if Great Britain were set off from Europe, the continent would supply itself usually, or require only a few million bushels, after its interior distribution was affected.

In other words the world is trying to deluge Liverpool with wheat, and finds elsewhere no markets that are worth striving for. This strife to supply England with wheat has reduced the price to a lower point than has been reached in 125 years, and will probably be recorded in history as the era of cheap bread. This I think is a sufficient answer to the question: Why is the price of wheat so low? The question: How can be make it profitable to raise? is answered in three words; raise less wheat.

Mr. Strong: Can we profitably harrow wheat or cultivate wheat with a horse hoe?

Dr. Beal: We have satisfactorily harrowed wheat at the College, but never cultivated it.

Mr. ——: English practice is eminently in favor of it for wheat, as well as for other crops.

Mr. Sharp: I know that, but that does not prove it to be good for us. They harvest in August, and have a long season like our June weather, which we have not.

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Mr. Osborn: A plant growing by itself is always slower in maturing, but I think if ground were well covered we might cultivate without making it too late. The English average wheat yield is 28 bushels per acre.

A few years ago Mr. Vandeventer of Sturgis got 60 bushels per acre by cultivating.

Dr. Beal: Some years ago a man in Oakland county invented a wheat cultivator, but I don't know whether it is now used.

Mr. Sharp: My family eat about seven bushels of wheat per head, and five to six bushels per head is about the average, and the increase of population will probably make market enough for our wheat.

Mr. Dougherty: We export only about ten per cent of our product.

Mr. Osborn: When you look at the fact that our yield per head has risen 400 per cent in recent years (30) and that the wheat fields of the west and of the Argentine Republic, and other contries, are just developing, it seems inevitable that the price of wheat is yet bound to go lower.

Dr. Beal: If we can lower the price of wheat the consumption per head will increase.

Mr. Osborn: Bread is cheap, but money is high. Of course, if every one is going to eat more it will raise the price.

POTATO CULTURE.

BY L. A. ASPINWALL.

Read at the Centreville Institute, February 19, 1889.

THE SOIL

best adapted to produce a fine quality of potatoes is undoubtedly the sandy or gravelly kind, having good drainage. Light land is sought by all experienced growers. The potato partakes largely of the nature of the soil upon which it is grown; those from heavy land being heavy and sticky in their texture, especially in wet seasons.

THE PREPARATION OF THE SOIL

is a matter of vast importance if large returns are expected. Many farmers do not fully comprehend this. It is far more profitable to concentrate the energy of plowing, manuring, planting, cultivating and digging five acres to one-half that amount, say two or three, from which an equally large yield can be obtained. To plow land and pulverize it in the most perfect manner without the application of something to increase the fertility of the soil can be of little or no profit. Most people expect too much for a given outlay, hence the great hordes who expect to make a lucky hit on the fluctuations of the stock market. Nature does not give something for nothing. The more we feed the land the more we receive in return.

Natural vegetable decay is undoubtedly conducive to the finest and healthiest growth—sod land or green clover plowed under is the most natural and best method of manuring, but should be supplemented by manure from the farm-yard or stables, together with manufactured fertilizers. In the vicinity of large cities, where land is cropped continually, a liberal dressing

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of stable manure becomes necessary, also the application of commercial fertilizers; stable manure should be well decomposed; green manure in dry seasons will remain undecomposed and the full benefit cannot be obtained; clover sod should not be less than eight or ten inches high, previous to plowing (which should be done during a damp time if possible in order to make the work of decay rapid and certain). By the addition of 15 or 20 loads of stable manure to the acre, plowed in with the clover, a fine yield may be expected. One acre well cultivated is more profitable than two poorly cared for; but you may say we have ten acres of clover sod to turn under for potatoes, and lack the 15 or 20 loads of manure for each acre—what shall we do? I reply: plant just what you can manure well, and should you have but 15 or 20 loads of manure, all told, plow but five acres of the clover and give your horses and the other five acres a rest—it requires as much horseflesh to plow a poor acre as a good one—everything needs rest, let the clover grow up and decay upon the ground (do not mow it), and it will be all right for another season; presume the whole ten acres were planted with potatoes, and a drought should set in, where would you get clover from, another season? Save some of your ammunition. Have you ever noticed, the poorest farmers have the greatest number of acres under the plow and the poorest horses, all worn out by plowing. Remember, "The merciful man is kind to his beast," and "make no haste to be rich if you would prosper."

We have now a field of clover ten inches high, thickly covered with manure well decomposed, the lumps broken and evenly spread; we have also applied a barrel of cheap salt to each acre to furnish soda and prevent the ravages of wire worms, all being plowed in as fast as spread to prevent any waste by evaporation. With land thus prepared, we are willing to consider that part of our subject under the head of

PLANTING.

In planting I would have the rows 27 inches apart, instead of three feet, as is the usual practice in Michigan (the fact is, poor land will not admit of close planting). I would then plant seed, cut to one eye, ten inches apart in the rows, and about five inches deep. Where machinery is employed for planting, it would pay to put about six or eight hundred pounds of some good potato fertilizer on each acre. Not that I place much confidence in commercial fertilizers. They must be used judiciously. They are stimulating, and give the young plants a start which should be supported by the clover and liberal dressing of manure. I do not believe in the use of commercial fertilizers alone. Referring again to close planting, with seed cut to one eye, it will be seen that the more we distribute the eyes (which are embryo sprouts) of a potato over a given area, in that propertion will the plants receive the full benefit of the manure, and where the land is thoroughly enriched, close planting must be practiced to produce large returns. The more we can realize from a given area the greater will be the saving in plowing and cultivation. The old system of planting whole potatoes has become almost obsolete; our poverty-stricken soils have driven us to a better method. Then again, seed cut finely will plant a greater area, other things being equal. However, we use more seed because of heavy manuring and close planting, and in return expect three or four hundred bushels to the acre. Thirdly,

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CULTIVATION.

About one week before the potatoes come up, the field should be harrowed with a light harrow to destroy the small weeds which begin to appear; the better plan is to traverse the field lengthwise, keeping the horses between the rows as much as possible to avoid treading upon the potatoes which are coming through the ground. If possible, the work should be done in pleasant weather, when a few hours of sunshine will destroy most of the young weeds. In about a week the potatoes will appear in clean rows, when the cultivators should be brought into play. In about ten days, pass through with the cultivators again. The oftener soil can be stirred and loosened to admit air and light, in that proportion will the crop be benefited. Where flat culture is the practice (which should be, except in wet localities), the last cultivating should be substantially as the first, excepting to set the cultivators to hill the row slightly. My experience has been, that a moderate quantity of earth is necessary to protect those potatoes nearest the surface from being sunburnt, or becoming green. The successful farmer has an antagonism to weeds, and would advise passing over the field with hoes to cover the few weeds likely to gain the ascendency; such work usually pays in the end. Clean cultivation should be the motto of every potato grower.

POTATO BUGS.

The only successful method thus far known for destroying them is by the application of Paris green or London purple. Either should be thoroughly mixed with water; Paris green should be in the proportion of a teaspoon heaping full to a pail of water; double the quantity of London purple is required. Although a larger quantity is needed the expense is about half that of Paris green. Apply with a sprinkling pot having a nozzle with numerous small holes. A stick will be needed to stir the poison occasionally, as it is inclined to settle. Two sprinklings are usually sufficient to keep the bugs in subjection.

In dry weather I would recommend mulching the crop; straw spread between the rows thick enough to cover the ground will pay well. Do you say, this involves too much outlay for a crop of potatoes? During an excessive drought when I was a boy, my father instructed me to drive the stock one mile twice a day for water; this did not involve too much outlay to save what we already had. The object is to prevent the loss of what has already been expended, and I know mulching pays in keeping the weeds down and preventing the intense heat of the sun from burning the potatoes.

In closing the subject, I would advise machine work whenever possible, and withal in digging, it costs more to dig a poor and weedy field by hand, than where it is clean and the yield large. But machinery knows no difference as to bulk of potatoes, weeds or condition and kind of soil. A row of potatoes is traversed by the digger under the variable circumstances in about the same length of time.

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APPLE CULTURE.

BY HON. N. A. BEECHER OF FLUSHING.

Presented at the Flint Institute, January 31, 1889.

APPLE STOCK—HOW PROPAGATED.

Sow the seeds in the fall, in well prepared soil, in rows, so they can be properly cultivated and cared for. The next fall the largest of them are taken up and placed in the cellar for root-grafting, and the balance left for another year's growth, when they are treated in the same manner.

GRAFTING.

Apples that are feeble in growth, and tender, should be grafted on some hardy, vigorous stock, like the Lyscom, Northern Spy, or Talman Sweet, when two or three years old.

It is difficult to ascertain whether the graft has more influence on the stock or the stock on the graft. In most cases, the stock seems to have the controlling influence, in others it is exactly the reverse.

Some twenty years ago I set out fifty seedlings, three years old; two years later they were top-grafted to Canada Red; twelve of them died and were replaced with Northern Spy. In the same plat of ground I whip-grafted three Lyscoms, two years old, at the time that I grafted the seedlings, and today they are much larger and stronger than those grafted on the seedling stock, and are exceedingly uniform in size and shape, while those on seedling stock vary in size, shape and vigor, some being quite strong and others dwarfish; a few, in time, died outright, and the remainder range from fair to good.

The best of those top-grafted on seedling stock measure now two feet nine inches in circumference, while the three Lyscoms, top-grafted to Canada Red, measured respectively three feet seven and one-half inches, three feet six inches, and three feet six inches in circumference.

The reason why I prefer the Lyscom, as a stock, to the Northern Spy or Talman Sweet, is that it is just as hardy and is a much stronger grower in root and branch. In fact, it will produce more root in a given space of time than any other variety I ever propagated.

It is just as necessary to improve the hardiness of tender varieties by top-grafting, as it is to improve feeble growers by the same means.

SELECTION OF VARIETIES.

A most excellent source of information on this subject are the reports of the State Horticultural Society, of Michigan.

Select the best five or six varieties of winter apples for market, adapted to the climate in which you live, whether the orchard be large or small. Will mention a very good selection for this purpose for Genesee county: Baldwin, Northern Spy, Canada Red, Golden Russet and R. I. Greening. This selection, properly cared for, in due time, will be as good as bank stock or wheat in the bin.

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HOW TO PLANT AND GROW AN ORCHARD.

Select a deep, rich soil. Should there be any places that are inclined to be wet, they must be well under-drained before setting the trees.

Let the ground be thoroughly prepared, then set the trees about an inch deeper than in the nursery, in well pulverized soil, using leaf mould, if you choose, but no manure. The latter, if used, should be on the surface as a mulch. Before setting, cut off all the roots bruised with spade, from the under side, so that the cut will set flat upon the ground. From this cut many little rootlets start out and go directly and naturally into the soil. Hence the necessity of following this plan. With your hand place all the main and fibrous roots in their natural position. Now let some one sprinkle on fine soil plentifully, while you perforate the same with your fingers, seeing that every vacancy is thoroughly filled and made compact about the roots. After this has been accomplished, fill in around the tree and pack the soil firmly with your feet and you will have no trouble in making the trees live.

Cultivate with some hoed crop four or five years, never letting it lie in sod more than two years at a time, if you would keep it healthy and vigorous.

HOW TO PLOW THE ORCHARD WITH HORSES.

Have a low hame harness; take turrets out of back pad; give horses loose check or none at all. Length of double whiffletrees, two and one-half feet; single whiffletrees, 22 inches. Wind whiffletree next to tree thoroughly with heavy cloth; put a man hold of the plow handles, and set him to work with this injunction: "Sooner skin your own shins than bark a tree."

PRUNING.

In growing the orchard we should grow it for fruit. In pruning have the same end in view.

This is not a very complicated art, and yet there is a science about it.

1st. Decide whether it shall be high or low. My preference is for the medium, all things considered.

2d. When to trim: June is said to be the preferable month, in which I quite agree; but do not always comply. Another very good time is from the 15th of February to the 20th of March, before the frost is out of the ground and when the weather is not too cold.

HOW TO TRIM.

See that the branches are well balanced and properly thinned out, to let in air and sunlight, leaving the west side of the top the heaviest, as it protects the tree from cold blasts in winter and the trunk from "sun scald" in summer.

One eminent Professor has said, "Never cut a limb off a limb." In this I can not quite agree. Take the Northern Spy for example, that is noted for its upright and matty growth; thin it out to the required number of main branches to make a well-balanced top when young, and it will not be long before the tree itself, so to speak, will beg for the thinning process to

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be applied, in order that she may vie with all other well pruned trees in choicest fruit. But let us not lose sight of the main rule, "Prune for fruit." Am sorry to say that some orchardists get a great way from the mark. They adopt the high plan; having this in view, they work for a six or seven feet trunk, and then apply the same principle to the main branches, that are often made bare of fruit buds, longer than the trunk itself, leaving a few side branches at the extremities of the limbs.

Then the trimmer gets down, steps back a little way, pulls off his hat, takes a look at what is left, and flatters himself that he has done a wonderful thing! I feel like exclaiming, glorious trimmer he; fruit buds nearly all trimmed off, commercial value of the tree ruined, he and his family suffering for the necessaries of life, consumers complaining that fruit is so scarce and dear.

I have often wished that such a tree, after it has been spoiled of its usefulness and beauty, had the power to retaliate on the trimmer.

HOGS AND THE ORCHARD.

There seems to be a sort of mutual relationship existing between the two. While hogs are a good thing for the orchard, the orchard is a good thing for them.

I plan to keep from fifty to sixty in the orchard from May until December. They assist largely in fertilizing the soil, destroying insects, beetles, and especially the codling moth, in the larva state, by eating the premature fruit as it drops from the trees, thereby doing away, to a great extent, the necessity of spraying the orchard. As their food supply increases they assume to be masters of the situation—are in favor of protection to home products, and are opposed to cider mills. As the season advances they greatly improve in appearance, if not in manners, wear jewelry in their noses, grow sleek and fat, and sleep in the shade.

GATHERING THE FRUIT.

One reason why the orchard and fruit fails to be remunerative is that the husbandman does not husband—fails to properly care for, neglects to gather the fruit at the proper time and put the same on the market when fresh and inviting; does not utilize it in a way to make it profitable. It is not so with the hay or oat crop, though it be ever so poor. Choice fruit is often worth more than the hay and oats put together. Would it not be a better way to care for them all with a wiser economy in view?

Never fail to have your barrels in readiness, with hoops well driven, before packing time. When ready, knock out one head from each barrel. Deliver the barrels in the orchard where needed. When filled they are placed on a stone boat, drawn to the barn or packing rooms, and remain there until packing season, where they are out of the storms.

Find live pickers that can pick not less than twenty barrels per day, and pay them well for it. Two men picked most of my crop the fall of 1887, averaging more than that number. Two men and a boy picked my winter fruit the fall of 1888, in all 1,149 barrels as they came from the orchard. One of the men picked 600 barrels, 477 of them in 16 days, an average per

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day of 29$\frac{13}{16}$ barrels. The same gentleman picked in one-half day twenty barrels of Canada Reds.

PACKING.

We use a table 28 inches high, 3½ feet wide, as long as you like, forming a box on the top 10 inches in hight. Into this empty a few barrels of apples and make your assortments. We make No. 1 and No. 2; the remainder goes to the swine.

Use baskets that can be turned in the barrel, always keeping one or more for facers. By this method sorters stand in an upright position, and rarely ever tire of their work. All are under cover, where the work is made pleasant, and the storms and cold do not interfere.

DOES THE ORCHARD PAY?

Will now give you the income of my orchard, of less than twenty acres, for the last six years, including packing and other expenses, and let you be the judge:

Received for 1883	$1,082 50
" " 1884	351 45
" " 1885	979 85
" " 1886	547 00
" " 1887	1,438 81
" " 1888	1,286 83
Estimated income from swine, credited to orchard, six years	600 00
Total	$6,286 44

Not a penny's credit is given in this account for all the other crops that have been grown in the orchard for that length of time.

The great Northwest will never raise her own fruit.

Peter Gideon, of Excelsior, Minnesota, has spent nearly a lifetime in propagating different varieties of apples from the seeds of the cherry crab, procured from the State of Maine, hoping to find something that would stand that vigorous climate. Peter Gideon is the man that represented the State of Minnesota, at the American Pomological Society, held at Grand Rapids, the fall of 1886, and there exhibited the results of his experience; the products of the crab family, the work of a lifetime. He told me at this meeting that the winter of 1885–86 froze his Wealthy and his Iron-clads to death in the nursery.

President T. T. Lyon of the Horticultural Society, of Michigan, has given some very valuable information touching this point in the Horticultural report of 1887, page 513, substantiating the same results.

The horticulturist of Michigan, then, has one very important thing in his favor. He will ever have his share of the great fruit market of that country to supply with fruit. Her population is rapidly increasing; the country is developing and the wants of the people are multiplying.

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APPLE GROWING FOR HOME AND MARKET.

BY PROF. L. R. TAFT.

Report of Talk at the Lake Odessa Institute.

I take it as an axiom that all farmers should grow their own fruit.

Orchards often fail to pay interest from being on the wrong kind of soil. A rich, sandy loam with a clay subsoil and properly drained is the best. Apples do not do well with wet feet. If you ridge the soil of your orchard for the sake of surface drainage, you should do it before setting out the trees, so as not to bury their roots too deep. A hoed crop, to clean the land of weeds before setting out an orchard, is a good thing.

We have heard much said of late in favor of "grass culture" for orchards, but I wish to emphatically warn you that with nine persons out of ten grass culture would be a complete failure, because the grass robs the trees both of food and drink.

Of crops to grow in an orchard, corn is probably the best. If no row is planted within four to six feet of the row of trees, and the ground is well cultivated, little injury will result.

With no crop on the ground, shallow cultivation is desirable to keep the soil moist. Deep cultivation tends to dry out the soil.

For one whose business is orcharding, the better policy is to grow no other crop among the trees; but ordinary farmers will probably take better care of the trees if there is a crop between the rows.

If the orchard is seeded down a wide mulch should be put around each tree. If the limbs make an average growth of twelve inches over the tree they are doing well enough.

Manures for the orchard should be well rotted, as when put on raw they cause too rank a growth. Rotted manure produces less wood and more fruit. Commercial fertilizers are hardly profitable, but unleached wood ashes, spread broadcast between the rows and not dumped against the trunk of the tree, are very useful. The potash of the ash increases the sugar content of the fruit.

The fall is, for most farmers, a more convenient time for setting out trees than the spring, and the trees grow earlier and are less liable to injury from drought; but on wet soils they should only be set in the spring.

Do not buy of agents. Go to the nursery yourself, if that is possible; if not, send to it direct without the aid of the agent. Agents charge from two to twelve times as much for their trees as the nurseries do.

For tender varieties, like the Baldwin, top working may be desirable.

A small number of varieties is better than a large number. For family use say two to three summer, four fall and six winter, and for market not more than two to four kinds in all, unless it be for a small peddling business.

As to the selection of varieties: For market, choose the bright colored ones, and consult your neighbors as to what do best in your soil and climate.

Plant the trees in straight rows both ways, from 30 to 35 feet apart. Press the soil firmly about the roots. Set the trunk straight up and down—not slanted, as some persons unwisely advise—and place the strongest roots on

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the side to resist the principal winds. A barrel stave set up south of the tree will serve a good purpose to protect the trunk, when young, from the sun.

The head should be formed pyramidally, with a straight central leader and branches on all sides. Prune so as to correct any bad tendency of the variety to be too spreading or too upright.

Some years two-thirds or even nine-tenths of the apple crop is infested with the codling moth or apple worm, which makes it unfit for anything but hog-feed.

Now this may be almost wholly prevented by spraying the trees at the time of the fall of the blossom or within a week thereafter with London purple or Paris green stirred in water. (Full directions as to how this should be done will be found in bulletin No. 53 on an earlier page in this volume, H. G. R.) This spraying kills enough other insects to pay for it beside the codling moth.

In gathering the fruit, treat it like a crop of eggs. Remember that bruising spoils it. Before packing for market sort carefully into first and second grade and culls, rejecting from the first grade all fruit that has any imperfection.

Mr. Stowell: Is not one pound of Paris green to 160 gallons of water too much?

Prof. Taft: No, but one pound to 200 gallons is enough.

Mr. Friend: In setting different varieties it is better to put trees of a kind in blocks together rather than to string them out in long rows sandwiched among rows of other varieties.

Does not spraying with Paris green kill the bees?

Prof. Taft: If so it can be avoided by postponing the spraying till after the blossoms have fallen.

Mr. Johnson: Do not wood ashes harden the soil?

Prof. Taft: A light soil, yes; heavy soils, not. Apply the ashes in the spring broadcast every year or two in a bearing orchard or in a young one if the trees show too slow a growth.

Mr. Wachs: Is salt a good application?

Prof. Taft: Chloride of potassium at $2 per cwt. is better.

Mr. English: What is the difference between a 10-inch and 42-inch hole in setting out trees?

Prof. Taft: In the small hole the tree will grow very little. For most nursery trees a two-foot hole is big enough. Solution of copperas is a good protection against fungus and scab.

Mr. Haw: How much would you prune back in the spring, trees that had been heeled in in the fall?

Prof. Taft: It depends on the tree and the condition of the roots. Make roots and top proportionate to one another. Peaches I trim to a single switch at setting, and head back one-third every second year; this thins the crop. Pears only prune enough for shape. The less the better.

Mr. Haw: Is pruning trees when they are frozen bad?

Prof. Taft: It is generally thought so. They heal over best when cut in June. Grapes I prune any time after the leaves fall till March or April, whenever there is no frost in the wood.

Mr. Johnson: Is land slanting one foot in five rods too flat for orchards in the matter of drainage?

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Prof. Taft: On tenacious land of such level, I should think drainage needful. Dig a two-foot hole in June, and if you find no water in it drainage is needless.

SMALL FRUITS.

BY MRS. R. D. PALMER.

Read at the Brooklyn Institute, Feb. 14, 1889.

Having cared for small fruit more or less for the last twenty years, I thought I might throw out some hints that would be of profit to others.

As soon think of buying all the milk and butter for family use, as to depend on others, for all the small fruit you need. It is a puzzle to me why so few farmers raise their own small fruit. Rather than go without, I would even dare to hint that the farmers wife or daughter might do something towards the care of this much desired luxury. It is no harder work than the care of flowers, which she esteems a privilege. Do I hear the cry from many of these farmers' wives, saying, for shame; do not put any more burdens on us poor overworked women. That is just what I was about to speak of. If you did not stay in the house from early dawn until late at night, and bake, dust, scrub, make and mend, you would not feel so careworn. And stop that worry. It is that which is killing our women, or making them grow prematurely old. Get out of that everlasting round of a treadmill and breathe a little fresh air and sunshine; just try it for one year, and get out an hour or more every day all through the busy season, and see if you do not come out more healthy and cheerful in the end. It will more than pay you for your labor, when you can have all the small fruit you need for your table and for canning. If people would use more fresh fruit through warm weather, and less meat, they would be healthier. One of the best medicines that I can recommend, is plenty of fruit and a reasonable amount of exercise. We would be much the gainer, if we would look more to our fruit for our medicines and less to our drug store.

STRAWBERRIES.

Our first ripe fruit here is the strawberry, which comes on about the tenth of June. If there is no strawberry patch on your farm, your first business should be to make one, never mind the kind, it depends more on the care for quality. If we wish to enjoy this delicious fruit at its best, we must raise it ourselves, and pick it when fully matured ready for the table, and not for market, for that has to be picked when not fully ripe, to bear transportation. I like summer or early fall planting. In July or August, the earlier the better. While more strawberries are planted in the spring than at any other time, certain advantages are secured by summer or fall planting. All plants that get a nice start by the first of September will bear large, nice fruit the next season, thus getting fruit in about ten months, while those set out in the spring must go about fourteen, for under no consideration should they bear fruit the first season. If blossoms should appear, pick them off.

The most favorable soil for strawberries is a sandy loam, a soil that will retain moisture—water is one of their chief needs—but not where

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water will stand and become stagnant. Moisture is essential to the best results, but there should be a good drainage. It is well to have the ground prepared some little time in advance, so that it may have time to settle somewhat before the plants are set. If you have not much land to spare, then double your depth and it will double your crop, for next to enriching the soil the most important step is to deepen it, from twelve to fourteen inches will do, and work in well rotted barn-yard fertilizer, as far as you go down. The surface should be quite rich that the young roots may not have far to go in search of food. Have the surface smooth and mellow.

Stretch a line down the length of the plat, two feet from the outer edge, and set the plants along the line, one foot apart from each other. Let the roots be spread out, and press the earth firmly over them with the fingers, leaving the crown of the plant even with the surface of the soil. Now we have the first row, move the line forward three feet, and set the next row, and in the same ratio fill up the bed. Set out your plants in the after part of the day, or just before a shower. Soak the ground thoroughly with water before taking up the plants. Take new runners that are well rooted. If you take them up with a ball of earth attached to their roots, it can be done so carefully that they need not know that they have been moved, but continue to thrive without wilting a leaf. Do not make your bed so large that you cannot keep it free from weeds; better have half as much and have it well kept, for it will produce as much in the end, and fruit of much better quality. If not convenient to cultivate, then keep them well mulched. Cover lightly with straw or marsh hay for winter protection. If you want some late berries do not uncover them very early in the spring.

To grow in hills, keep all runners cut off; it is claimed that for each runner thus cut a crown is formed on the old plant, which puts forth one or two fruit stems, the fruit on these being much larger and finer than those from matted rows. If in matted rows, leave them a foot or more wide. The next season, after they are through bearing, if intended for fruit only, cut off with a shears or knife, all the first runners that appear, thus giving vigor and strong growth to the set plants (the clipping off runners is a good out-door exercise for that little girl or boy). In August, allow the runners to grow out. Keep them well mulched with clean straw while they are bearing fruit; it will not only keep the fruit clean, but will help them through a drought.

Now comes the question, what kind of strawberry is the best? It is not so much in the name as in the care you give them. Some of these new kinds with a king or queen attached to their names sound very nice; we send for them, pay a big price and plant them in our common soil, and in nine cases out of ten, the king or queen becomes dethroned, and they are no better than our despised Wilsons. I have Sharpless, Pioneer, Seth Boyden, Monarch of the West, Bidwell, Manchester, Jucunda, Wilson and three or four more kinds, but I would not give up the Wilson for many of these new kinds. It has stood all kinds of abuse for more than thirty years. If you wish for beautiful berries, grown on thrifty Wilson plants, set out plants on the runners first or second from the parent plant; they will be stronger and bear larger fruit. And give them a fertilizer of leaf mold from the woods. And do not pick them until fully ripe.

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OTHER BERRIES.

Now we have plenty of strawberries, but do not think that will do, for less than a half acre well laid out will supply a medium-sized family with all the small fruit they need, and if you will use your brains as well as your hands there need not be a day from early June until frost comes that you cannot have fresh fruit of some kind. And let that half acre not only be a profit but an ornament to the home. So observe order in all your planting. Do not forget that weeds are not profitable nor ornamental.

Raspberries come in next; set them four feet apart in the row, and the rows six feet apart; and the same with gooseberries and currants. Keep them cultivated or mulched. Cut out old raspberry canes as soon as the fruit is off; allow only as many new shoots to grow as are needed for fruiting, and pinch off the end when three or four feet high. I have the Gregg and the Miami black caps. The red raspberries and blackberries are not so easily kept just where you want them, but we must have them, although those great thorns of the Kittatinny blackberry do not give one much pleasure in trimming and caring for them; but you had better do that than depend on the fence corners. My Wilson blackberries I lay down and cover with marsh hay for winter protection. This fruit comes in just when we most need it. I have some of the Wachusett Thornless, but the fruit thus far with me has been almost worthless. Keep them in rows three feet wide; cut out the old canes when through bearing, and pinch back the new growth when five feet high.

GRAPES.

Our last small fruit of the season is the grape, and that if properly packed with fine cork can be kept until in the winter. Grapes should be set eight feet apart in the rows, and the rows twelve feet apart. The vine for the first year should bear but a single shoot, the second year, two shoots. Upon an old vine each shoot usually bears three clusters; if the stem beyond the last cluster is pinched off at two or three leaves, the fruit will be larger and the stem stronger.

I am in favor of fall pruning, or at least the work should commence in the fall. I sometimes practice the short spur pruning, that is, cut back to two buds, and then it will need some summer pruning. I prefer the wire trellis. The trellis consists of four wires on posts set at convenient distance, the lower wire two feet from the ground, and the upper one six. The vine should be grown with one or two main stems or trunks from near the ground. Leave these trunks nearly the height of the upper wire, and train the arms along each wire; these should be cut to six or eight buds each, and the shoots as they grow are pinched off during summer, to two or three leaves beyond the last cluster, and as the end buds start out pinch that back to one bud. The fall pruning consists in cutting off the entire arm up to the cane nearest to the trunk, and shortening that cane to six or eight buds. And then I take them from the trellis and lay them carefully on the ground and leave them there until the buds are ready to start in the spring. I have the Delaware, Niagara, Worden, Massasoit (Rogers No. 3), Agawam (Rogers No. 15), Salem (Rogers 22) and a few vines of the Concord. They are considered the most hardy grape we have, and will bear fruit when others may fail, but they are not the best, and report says they are apt to be troubled with the

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grape rot, which my grapes thus far have been free from. But I always burn all the trimmings both from grapes and other small fruits.

LIVE STOCK ON THE FARM.

RICHARD DOUGHERTY, COLON.

Read at the Centreville Institute, February 18, 1889.

In breeding, like begets like. "Like father, like son." "No great man but that had a great mother." These are old sayings, and as true of animals as of humanity.

All improvements in stock are made by mating, care and feed. Without good care, food and water, deterioration must follow. Stock should have good care first, last and all the time. Instead of trying to find on how little feed we can keep our stock, we should try how much we can get them to eat.

They may be considered as machines to manufacture butter, beef, wool, mutton and pork, from hay, straw, corn fodder, grass, and coarse grains. The sooner stock can be brought to maturity the more profit. Young animals get more nutriment out of a given amount of feed than older, hence are more profitable to the feeder. For calves and sheep, whole grain is a better ration than ground feed. Corn and cob meal is as good, or better, than whole corn meal, unless it is mixed with bran, chaff or cut straw. Warm yards and stables save feed, as they help retain animal heat, which otherwise must be supplied by food. Good air, good food and water insure good health, without which no animal can prosper. Cold weather requires more feed than warmer. All animals should be kept dry, warm and clean. Some succulent food, as roots or ensilage, should be given daily, in winter, to all live stock.

Every farmer should raise some crop—as oats, rye or corn—to cut green to bridge over any failure of pastures from drought, or have a filled silo from which to draw feed in such times. Mill-feed, slops and clover pasture are better for hogs than corn in summer.

Animals should be kept growing every day till mature, and never allowed to stand still or go backward. A calf or young animal losing what may be called its veal fat or flesh never recovers it in its full beauty and excellence. Should a growing animal become a starveling it can never, by the most careful feeding, be brought up to its maximum, but will always show it in some way. When full maturity arrives in an animal designed for food it should be disposed of as soon as possible, as it is difficult to keep it up to its full form and excellence, and all feed spent solely in keeping may be counted loss. Weight by increase of fat alone cannot be put on profitably.

Calves fed from the pail are more docile than those that follow their dams, and are generally better rustlers and make better cows. Milk your cows, take twelve hours' cream from the milk, then feed the milk to the calves, enriched by Blatchford's calf meal. Stock going into winter quarters in good condition may be considered as well on in the winter, compared with those in poor condition. Therefore, as food fails in the fields, let it be supplied from the barn or silo.

Never let stock be out in cold rains or snows, as it pays to keep them comfortable at all times. If an animal be overfed, or cloyed, the best medi-

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cine is good feed given sparingly. Cattle turned out to grass in the spring should at first be left only a short time each day, and be supplied with hay or good straw, which will prevent Hoven or bloat, or scours, and sheep are also benefited by same care.

The best way to salt animals is to keep it where they can get it when they want it, and they will never eat too much after they have been prepared for it. But I believe as generally given it is a damage rather than a benefit. A spoonful is enough for a cow or a horse, and more is worse than none, as it is a rank poison. Stock should have access to pure water at all times.

No man is fit to care for stock who cannot gain their friendship, or who prefers to toast his shins to caring for his stock.

To make stock profitable, they should be like good Christians—fit to live, or fit to die. Have them ready for beef, pork or mutton. They keep easier, grow faster, give more milk, beef, pork, mutton or wool, and bring their owners more money, more satisfaction, more self-respect and more respect from others, for we can hardly respect a man who keeps a lot of stock around him at starvation point.

I should say farmers do not raise enough stock. I think I hear some one exclaim, "I raise all the stock I can feed." Well, if you do, the general farmer of St. Joseph county does not. Their plan is grain, grain. The West is a vast grain field. A piece of land lying in grass seems to be thought a field lying in waste. For over fifty years the farmers of St. Joe county have been following the depleting process, till even in grain-raising we stand at the foot, or near it, as compared with other counties of the State. I have been trying to profit by the experiences and facts gathered by these professors, and from these facts I find the more stock kept on a given area, the more grain and grass per acre does the land produce, and the more money they make and the more valuable their farms become. Some one says St. Joe county is not a grazing county. I don't know about that; I have seen more stock kept on a given area, and well kept, than in any other place I know of.

It is true we have been having a series of dry seasons, in which our pastures were dried up, but I never saw it so dry here, or our cattle suffering so much for feed and water, as I did in the west two years ago; and we have never had a summer in which a farmer could not raise a heavy growth of corn fodder on well improved land. There is no plant that will yield more feed than corn, that I ever had any experience with. Corn fodder green, corn fodder dried, or made into ensilage, or all together, will enable farmers of St. Joe county to compete with farmers in any other section of our country. At least one-half of the money produced from the farm should be from animal products.

One thing more and I am done. Your stock generally, except hogs, are not of the most profitable kinds, cattle especially, and as good cattle were never so cheap as now, to my knowledge, now is the time to get rid of scrubs and get good grades or thoroughbreds. You cannot afford to raise any but the best. Let the cheap lands of the West raise the scrubs, and let us raise better stock.

H. G. Reynolds: The rule given by the writer to skim twelve hours after milking, and give the skim milk to the calves, is one that would work differently for the calves with different breeds of cattle. Thus Jersey milk would

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part with most of its cream in that time, while Ayrshire milk would still have a large proportion of its cream left in it.

Rev. ——: Does the writer practice his own doctrines?

Mr. Angevine: I believe he does.

Mr. Hanshaw: As a cattle breeder, Mr. Dougherty has done more for the county than any other man.

As to watering stock, I used to let my cattle drink at the river, and in that way lost $700 worth. I then concluded that either the water was too cold for them, or something was the matter, so I fenced them off from the river and took to pumping. I lose no more now, but even now the water in my tank gets ice cold and on that they don't seem to do well, and the question with me is, shall I warm the water? I find that the butter that I make costs me 25 cents a pound from two grade Short-horns, with 10 to 12 pounds a week from both. A neighbor makes 14 to 15 pounds a week from one Jersey.

Mr. Dougherty: I do not warm my water, or think cold water bad for stock, if not too cold.

Dr. Beal: I warm the water for my horse in winter, and think it is better for him. Perhaps the gentleman has not cows enough to make butter profitably. Or perhaps he fails to get all the fatty matter out of the milk.

Mr. ——: The age of animals to slaughter for profit is an important question. At our hotels the usual bill of fare is veal or beef, and it seems to me unwise to kill young animals, and I believe that the last year of the five years of a bullock's life is the most profitable. The dairy farmers of Illinois veal their calves and raise no stock.

Mr. Shurz: Mr. Dougherty says to keep stock growing all the time and sell as soon as mature. When are they matured? Shall we sell at three if heavy enough, or shall we keep till four. Also, I would ask Mr. Dougherty if we can afford to raise roots for stock.

Mr. Dougherty: Sell cattle, when they weigh 1,500 pounds, at two and one-half years old. Weight after that point costs more than weight before it is reached; so of all other live stock, the younger they are, the more they get out of their food.

Roots are not very nutritive, but some succulent food is very healthful for cattle. I have raised rutabagas so that I could load the wagon without moving it. But I think ensilage is going to replace roots as succulent food. I am using now Blatchford's calf food, and am pleased with it. Cornmeal is too concentrated for calves, and needs, for their health, to be mixed with cut feed.

Mr. Hanshaw: I used to feed bran, and had better luck than now. Now I feed corn and oats and rye, and think the trouble is that I need the bran.

Mr. ——: I used, as a boy, to feed turnips all winter to cattle who got no water and nothing but roots and straw, and they grew fat as butter, but we can't grow roots here profitably, and corn is and must be our dependence. I would give one-third oats, one-third corn and one-third bran for making butter. Roots flavor butter.

Mr. Dougherty: I like to have calves thrifty and growing fast, but I would not feed them such fattening food as too keep them beef fat all the time, because I think that if that is done they will never get to be good milch cows.

Prof. Cook: One of the best points made is the importance of getting rid

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of the scrubs and substituting better cattle. I would not advise farmers to buy high priced full bloods. Most farmers have not been accustomed to giving the care needed by high bred animals. But they can afford to grade up. Every neighborhood ought to have a full blooded bull.

Mr. Dougherty: Are not high grades better feeders than pure bloods?

Prof. Cook: I doubt it. Mr. Watkins at Manchester is a large feeder and greatly prefers the pure roan Shorthorn. Last summer we had poor pasture and ran short of food. Should we sell part, or put all on short rations?

Mr. Dougherty: With corn as cheap as it is keep them all up until buyers will give good prices, but sell rather than let any go poor.

Lieut. Simpson: The great pastures of the world are in the west. Cattle have replaced the buffalo. Now if Michigan would compete with the west, she must use the best breeds and the best methods. A year ago last fall many farmers found themselves short of feed, and those who bought extra feed to carrry all through, lost money, as the west kept up the supply of stock and kept the market down.

Dr. Beal: As to buying feed for stock, there is a counterbalancing element of profit in the manure.

Mr. Dougherty: Breeding animals should not be kept fat on high feed.

Mr. Hanshaw: I heard a man say that if he could not afford to buy feed to feed out, then he could not afford to feed out what he raised himself. Is that so?

Lieut. Simpson: It is a question of times. Sometimes yes and sometimes no; but we must remember that it is the western supply that controls the market.

Mr. ———: How about dehorning?

Mr. Dougherty: I have no experience.

Prof. Cook: I rode 18 miles through the place where the idea originated and did not see a horn in the whole distance. They seem to approve it.

I lately talked with Mr. J. S. Woodward who buys sheep in Michigan to feed in New York State, and he says he cannot afford to pasture sheep. He sells two months old lambs to the New York market at ten dollars apiece. He has very warm barns, and has his lambs dropped in the fall. He feeds the sheep ensilage and all the grain they will eat, and the lambs suckle the dams. They are Dorsets, Shropshires and Grade Merinos. He feeds rye, oats, bran and oil meal. He keeps no cows usually, but this fall bought 200 milch cows and expects to beef all of them next spring, and meanwhile to pay for them in the winter from milk and butter. His ten dollar lambs dress 24 pounds and weigh 35, alive. He feeds altogether ground feed.

Mr. ——: Everyone here feeds whole grain.

Mr. Jas. Major: I have had a little experience in dehorning, since a year ago. The animals did not seem to suffer and now don't injure one another. I cut the horn one-half inch below the base of the horn, but that varies with age. Older animals should be cut a little lower. I fill the cavity of the horn with cotton saturated with weak carbolic acid. I dehorned 50 head of Mexican steers in five to eight minutes apiece. An 18 inch fine hand saw is best for the purpose.

Mr. Holt: I had a vicious cow and had her dehorned, and the only trouble was she shrunk on her milk the first night, and that was all.

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PREVALENT DISEASES OF BONE.

BY E. A. A. GRANGE.

Delivered at Institutes held at Albion, Lake Odessa and Brooklyn.

As I am often called upon by owners of horses to advise as to the treatment or prevention of certain bone diseases, it has appeared to me that a general discussion of them at our Farmers' Institutes this winter would be of interest to many, so I have selected three which I believe are oftener met with than any others, viz.:

SPLINT, RINGBONE, AND SPAVIN.

Splint or Splent.

In order that the description of this disease may be better understood, perhaps it may be well to briefly describe the part affected. If the leg of a young horse be examined after the skin is removed the part below the knee and above the fetlock will be found to be composed of three bones, a large one (the cannon) and two small ones (the splint bones); the latter are situated behind and towards the outside of the former, and assist in forming a groove through which the back tendons play; they extend from immediately below the knee, in a tapering manner, downwards, until they reach the lower third of the cannon bone, where they terminate in an unattached eminence, sometimes erroneously mistaken for disease. The small bones are attached to the larger one, in young horses, by a fibrous, sinewy-like substance, which retains the bones in their proper position until the animal comes to a certain age of maturity, when the connection becomes converted into true bone. So, in aged animals, the cannon and splint bones are all one.

There are several varieties of splints, but as they are all modifications of the same complaint their difference will be better understood as we proceed. The disease may be defined to be a bone tumor, situated between the knee and the fetlock, which tumor literally welds or splints the bones together, and as far as the nature of the disease is concerned, it is identical with spavin and ring-bone, but it is not nearly so serious in ordinary cases. In the majority of instances they are located on the inside of the foreleg, anywhere between the knee and the lower attachment of the bones, but in horses of certain conformation, they are sometimes found on the outside of the leg; horses for instance whose toes turn inward,—pigeon-toed horses, as they are often called, are liable to have splints on the outside of the leg on account of the weight of the body being thrown in that direction, whereas in ordinary horses the center of gravity is toward the inside. It sometimes occurs on the outside of the leg also from external injury, as from a kick of the boot of some rough attendant, or other blow. When the disease occurs in the hind leg, as it sometimes does, it will be found as a rule on the outside.

Splints are generally found in young horses, especially those which are used for fast work upon the hard road, or the part subjected to greater strain than nature has intended the fibrous structure alluded to to sustain; the consequence is, that in order to strengthen the part this bony union, or splint as it is appropriately named, is thrown out, and taking this view of it,

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it is questionable whether it should be meddled with for the purpose of removal, except when it causes lameness or otherwise injures the animal. In my own opinion it should not, as I believe it is an evident effort of nature to strengthen the leg and render it capable of sustaining the strain imposed upon it, so can only be looked upon as an eye sore, for the time being, and when the time comes for the connection between the bones to become ossified (converted into bone), the part thus strengthened, and the splint being of no farther use, is removed by natural absorption. This is one reason why splints are so seldom found in old horses. But on the other hand, when it does cause lameness, or from its situation is likely to, or if it in any way interferes with the usefulness of the animal, then another view must be taken and treatment resorted to, which must necessarily vary according to circumstances.

The symptoms in the majority of instances are very plain, there being a well-marked irregularity in the otherwise smooth surface of the part. This enlargement varies considerably in size, from say a pea to a walnut, and may or may not be accompanied by lameness. It often happens when a splint is first forming, and the bony matter is thrown out quickly, that although the enlargement is scarcely perceptible, yet the lameness may be intense, which may be accounted for, however, from the fact that the covering of the bone (the periostium) is an inelastic membrane, and being severely pressed upon by the deposit underneath it the irritation gives rise to inflammation. It has been likened to a tight-fitting boot pressing upon an inflamed corn—the inelastic leather being compared with the periostium. This state of affairs gives rise to lameness which is peculiar and characteristic, and sometimes precedes the enlargement. The animal, after a day or two's rest, will come out of its stable almost sound, but when compelled to trot for a time will go lame, which increases on progression. A horse lame from splint will walk sound, or nearly so; but the very evident nodding of the head when trotted is out of all proportion to the scarcely perceptible lameness of the walking gait.

Horses lame from this disease will be further noticed to trot in a peculiar three-cornered sort of way, giving one the idea of what is sometimes called a "dog-trot." No doubt going in this sort of way somewhat modifies the extreme flexions of the knee. Pressure upon the part with the ends of the fingers causes pain, sometimes causing such agony as to force the animal to stand upon its hind legs. In some extreme cases, when first forming, the pain may be so great that the unfortunate creature is unable to bear any weight upon the limb, and will stand with its toe merely touching the ground. In such cases prompt remedies are often advisable, and an incision through the covering of the bone will sometimes afford instantaneous relief. When this disease is situated as high up as to affect the bones of the knee joint it has been described as spavin in the fore leg, but this term is hardly admitted in scientific veterinary works of the present day. When the disease is high enough up to affect the bones of the knee the lameness is often of a very intractable nature.

The Treatment

of this disease, when it is resorted to, must depend a great deal upon circumstances. In olden times all sorts of absurd and even cruel practices

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were resorted to to remove the enlargement—such, for instance, as thumping it with a hammer, or rubbing it violently with a stick or polished bone, and even boring the substance with a gimlet. These remedies, if not carried to the extreme, somtimes effected a cure, but oftener—especially the boring—left matters worse than they were before. But whatever form of treatment is to be adopted, the operator must first of all take into consideration what he wishes to accomplish, and then resort to those means which are best calculated to suit the purpose. For instance, in those cases which are rapidly forming, and the object being to relieve the pressure upon the tumor, the operation of "periosteotomy"! (a very formidable name for a very simple operation) is often performed with marked beneficial results, and instantaneous relief given. The operation consists in making a transverse incision immediately underneath the enlargement and through the skin; an instrument for the purpose is then passed between the skin and the bone and the covering of the latter divided. The lips of the wound should now be brought together and treated as an ordinary wound. In many cases of this kind relief may be obtained by several hours' steeping in warm water, by which means the risk of an operation is evaded and there is no possible risk of a blemish, provided the water is not hot. It should not be warmer than can be borne by the hand. The temperature should be kept up by renewals of hot water. This may be followed by a blister; sometimes setons are used, but they are more liable to leave a slight blemish than the blister. Often firing is resorted to, but in ordinary cases is perhaps rather a severe mode of treatment. A blister of the biniodide of mercury applied in the usual way acts well, when this form of treatment is determined upon, or even two may be required.

Bone-Spavin.

In speaking of this disease it may be well to mention, in the first place, that there are three kinds of spavin, which, however, are separate and distinct maladies, differing from one another in almost every particular, even the structures involved belonging to different systems of the animal economy. When horsemen speak of spavin without qualification, they mean bone-spavin; but when the other two kinds are referred to, they are qualified by the adjectives, bog or blood, as the case may be. So, in future reference to the disease now under consideration, it will be called simply spavin. As a disease, it gives rise to more trouble and annoyance than probably any other disease of the hind leg, being perhaps a more frequent source of lameness than any of the others, and in most instances very intractable to remedial agents, so much so that some experienced persons look upon it as a "bugbear" in horseflesh. In a thoroughly established case it is an incurable complaint, although in many instances the lameness may be entirely removed, and that is thought to be a cure by those who are not conversant with the changes which take place in the structures involved, while the so-called curative remedies are being applied. In many respects this is one of the most interesting lamenesses brought under our notice, and one which, if proper judgment is exercised, will reflect credit upon the operator, not only in the treatment of the complaint, but in the condemnation of those horses which are likely to become affected. In such a brief description of the malady as this, only those prominent features which are of popular interest will be dwelt upon.

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The disease may be defined to be a bony tumor, situated, as a rule, on the front and inside of the hock-joint. Some have described the disease as existing in the fore leg, confusing it with splint; but this is not admissible according to the general acceptation of the term spavin, at the present day. These tumors are sometimes found high up, and involving the upper bones of the joint, while others will be found low down, their influence not extending, perhaps, beyond the head of the cannon-bone; the former is very serious, giving rise in most instances to very troublesome lameness, while the latter may grow to a considerable size without causing any apparent inconvenience to the animals, and is often called, for some reason unknown to me, "Jack spavin."

The causes of this disease are looked upon as constitutional or hereditary, and local or exciting. The first is the result of breeding from unsound animals. This cause is now, happily, on the decline, but it is within the recollection of nearly every horseman that many thought anything in the shape of a mare would do to breed from, and it is a notorious fact that the get of some stallions is conspicuous from the number of their colts affected with bone disease of some sort, often spavin; but as breeders are, in the majority of instances now, so well aware what can be done by breeding from selection, it is to be hoped that this course will, ere long, be among the things of the past. Conformation is also thought to be a common cause, and those hocks that are narrow from before backward are thought by the supporters of this theory to be prone to the disease; but who is there of experience who has not seen the disease in every variety of shape of hock? The exciting cause is hard work, such as will cause undue strain upon the hock-joint, often the result, for instance, of compelling light horses to back very heavy loads, especially when they are young and the joint has not fully matured. Over-training of young race-horses (trotters or runners), military evolution, when the halts and turns are sharp, is a fertile source of this complaint; in fact, anything which tends to produce concussion, or strain the ligaments between the wedge bones.

The symptoms of this disease are various. The first generally noticed is lameness, with a peculiar rising and falling of the croup. When spavin has existed for a variable time, the animal will be observed to rest on its toe while standing, and if compelled to move its hind quarters, over a step or so, will do so with a kind of hop. This is one of those varieties of lameness which improves on progression, and it will be noticed that when the animal is first led from the stable, especially in the morning after a long drive, it will be quite lame; then drive it a mile or two and the lameness will begin to subside, if it does not pass off altogether; now let the animal rest for an hour or so, and the lameness will return to again pass off with exercise. It will be noticed, in cases of long standing, that the toe of the shoe of the affected leg will be much more worn than that of the opposite limb. If both legs are affected, the animal, while standing, will be observed to rest first on one toe, then on the other, and will travel in a peculiar, short, stilty sort of way. It will be often noticed that the muscles of one hind quarter will appear smaller than the other, the difference, in many instances, being very perceptible, so much so that this is often thought to be the seat of the lameness, and the unfortunate animal put through various forms of treatment for hip joint affection, when the ailment is somewhere else; but those persons who have followed and closely observed spavin throughout all

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its stages, must have noticed that this atrophy (wasting) of the muscles is a common accompaniment of chronic cases. The spavined horse, when trotting slowly (which is the proper gait to see the lameness plainly) will step upon its toe; dig it as it were into the ground.

With the foregoing symptoms presented, the examination to confirm the disease must now be continued by inspection of the seat of the complaint. If only one leg is affected as is generally the case, the examiner should stand about three feet from the horse's shoulder, and look carefully to see if any marked irregularity exists at the seat of the disease. Some horses are naturally rough at this point. So first one leg should be examined then the other, and if they are both alike and the horse goes sound they may be looked upon as safe. In making an examination of this kind, if the horse's leg is rough and hairy, it is a good plan to sponge the part, so that the wet hairs will lie close to the skin, and any irregularity of outline is much more easily detected. The hand should now be passed down the inside of the leg and the part carefully manipulated with the end of the fingers, taking care to notice any difference in temperature of one hock or the other, for there is a form of this disease termed occult spavin, where there may not be any external enlargement, yet the hock-joint lameness is severe and difficult to get rid of. This is a form of spavin which is most puzzling to amateurs, and often causes them to make up their minds that the trouble is in the hip, especially when the wasting, before alluded to, occurs, but the inflammation of the part, with the history of the case, materially assists one in forming an opinion. To thoroughly appreciate the symptoms of this disease, one should watch carefully the progress of several individual cases. In making an examination of the hocks, prior to purchase, one must be careful not to be misled by a fresh wound over the seat of the disease, for the skin has more than once been abraded by dishonest venders, and the explanation made to the purchaser that "the horse got its leg over a trace-chain;(?) or got kicked by another animal;(?) and that things would be all right when the wound healed;(?)" when, in reality, the wound has been made for the purpose of practicing deception.

Treatment.

The operator must bear in mind that this is an incurable disease, and that removal of the lameness is all that is to be looked for, although cases will occur where even the enlargement will subside, to a considerable extent, with the lameness; but those conversant with what is termed archylosis (union of bones) well know that the disease still exists. The union of the different bones affected is the object of rational treatment, and to do this various remedies are applied, in the shape of what are called counter-irritants. These consist of various kinds of blisters; also setons are sometimes used. The firing iron is looked upon by many as the quickest and surest way of getting rid of the lameness, and the operation, if properly performed, often reflects credit upon the operator.

There are several modes of operating, according to the fancy of the practitioner. For amateurs, who are not within reach of a qualified veterinarian, perhaps the blistering process is the safest and best form of treatment, and maybe there is none better than

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the biniodide of mercury, applied in the following way: Take of biniodide of mercury, one part, fresh hog's lard, eight parts, say two ounces, and apply as an ordinary blister, by rubbing in a small quantity at a time, and continuing the operation for ten minutes. Thin skinned horses will require less rubbing than those with thick, coarse hides. If the hair is long it should be clipped closely off. After the blister has been applied, tie the animal's head so that it cannot gnaw the part, and keep so for twenty-four hours, then wash the blister off with warm water and grease the surface with fresh lard, or olive oil. Grease every week until the new hair begins to grow. In recent cases, where there may be active fever in the joint, it is well to foment it thoroughly for a few days before applying the blister.

The lameness from this disease can generally be overcome in young and middle aged horses, but in old animals, especially if it has existed for any length of time, it will baffle all forms of treatment in the majority of instances. The animal should not be worked during treatment. The blister may be applied every three weeks or so until, say four, have been put on, and the animal kept in a loose box or allowed to run in a quiet pasture, except when it is necessary to secure the head while the blister is doing active work.

Ring-bone

is a name applied to a deposit of bone between the fetlock joint and the coronet, or upper part of the foot. The condition is so named from the appearance the deposit gives to the part, it often seeming to the observer as if a ring of bone had formed around the pastern joint. These deposits do not always extend completely around the joint, but may be situated at the side, when they are sometimes erroneously confused with "side-bone," a disease, as already described, of an entirely different nature. The nature of this disease (ring-bone) in a scientific point of view, is identical with bone spavin, they both belonging to that class of osseous diseases termed *exostosis*, the principal difference between them being their situation. The deposits of ringbone are found in one of two places, and in such a position as to either affect the pastern joint or the one below it, called the coffin joint. In some instances it may involve both. Some authorities have described it as occasionally affecting the fetlock joint, though rarely. This disease, like spavin, is incurable, although the lameness caused by it may be overcome, which is usually spoken of as a cure.

Ring-bones sometimes assume considerable dimensions without ever causing any apparent inconvenience to the animal, while much smaller ones give rise to very intractable lameness, the degree of which depends materially upon the extent to which the internal structures of the joint are involved. When the lameness has been successfully combated, and the union of the bones completely effected, it is sometimes astonishing to see how much of the enlargement will become absorbed, so much so that casual observers will be often led to believe that the disease has been completely cured, and this is only a natural supposition, for in such favorable cases not only the lameness but the enlargement have entirely disappeared, but were the bones of such a case cleaned of their external covering, it would at once be seen that two of them at least had grown firmly together, or in other words, that the process of "anchylosis" had taken

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place; but when this occurs the lameness, in the majority of instances, subsides, and the enlargement, to a greater or less extent, disappears.

The Cause,

or rather the causes, of this disease may first of all be included under two heads—the one being hereditary or predisposing, the other being exciting. Of the former it may be said that some sires are notable for the number of ring-boned colts they get; but the fault is not always on the sire's side, for the dam is often to blame, and breeders of experience will refuse to breed from diseased mares, unless, indeed, the condition has been caused by some external injury, as, for instance, the tread from the sharp calk of the opposite shoe. So those who persist in breeding from ring-boned mares will be often gratified to find that their colts are affected with this disease before they are asked to do a day's work, the probably miserable creature becoming a thorn in the owner's side from the day of its existence.

Then of those which are born predisposed to ring-bone, the conformation has to be considered, and it will be found that those horses with upright pasterns, if used for fast road purposes, are likely to throw out ring-bones. The reason why this style of conformation should render such animals more susceptible to the disease is because the column of weight being more in a straight line than in those animals with oblique pasterns, the concussion caused by pounding on a hard road is much greater, which sets up irritation in the part, which in its turn is followed by inflammation and bony deposit. But not only does concussion produce this disease, for it is often the result of a strain, and this is perhaps the common exciting cause when it is found in the hind leg. Of the exciting cause it may be said that hard work of any kind is liable to produce this complaint, such as severe galloping, trotting, jumping, over-driving colts, allowing colts to follow their mothers for a considerable distance (say miles to market) upon the hard road. The concussion thus set up in the young bones, before they have properly matured, is also thought to be a fertile source of this disease, and it is sometimes the result of external injury. It is also more likely to occur in those animals whose pasterns are unnaturally long and oblique, for the increased amount of leverage occasioned by such conformations is almost certain to produce too severe a strain upon the parts where animals, especially young ones, are called upon for an extra effort. Standing on one foot while the opposite one is undergoing a course of treatment sometimes produces the complaint.

Symptoms.

The disease will be found oftener affecting the hind feet than the fore, showing clearly that severe strains have much to do with its production. The gait of the animal lamé from this complaint is peculiar and varies much, according to the limb affected. If, for instance, the disease occurs in the front leg, it will be observed that while the animal is progressing it will bring its heel to the ground first; while, if the hind leg is affected, the toe will come to the ground first. This difference in progression is very well marked, and can be readily seen by the most casual observation, but is a circumstance which must be borne in mind during the treatment, or efforts to alleviate the suffering of the animal. In the early stages of the

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disease the first thing noticed is lameness, accompanied with a variable amount of fever in the part. Now, if the inflammatory process can be checked in this stage before the deposit has taken place, the disease may be warded off. Then, on the other hand, the owner's attention may not be directed to the part until the enlargement has actually occurred. When the disease is thoroughly established, the animals, if lame, will get better with progression, sometimes coming out of the stables excessively stiff, and after being driven for a variable distance will begin to go comparatively sound until the limp can scarcely be noticed. This has been accounted for from the fact that motion stimulates the secretion of joint oil (synobia), and that this lubricant facilitates the movement of the joint to such an extent as to cause little inconvenience to the animal. There can be but little doubt that the other structures accommodate themselves to circumstances also with progression. When the creature is in the stable it will stand in that position most calculated to ease the part. If the hind leg is at fault, it will rest upon the toe of the diseased foot; if the front leg is wrong, the affected foot will be kept often in advance of its fellow, and careful observation will detect that more weight is borne by the well leg than the disabled one.

In the treatment of this disease we must first of all consider what is to be done, and then use those curative methods which are best calculated to accomplish our object; but the fact must not be lost sight of that when different feet are affected different symptoms will be exhibited. When, for instance, the front feet are affected, and the heel comes to the ground first during progression, they should be shod with thin-heeled shoes; but, on the other hand, when the hind legs are at fault, and the toe is brought to the ground first, the high-heeled shoes must be applied. By observing these rules in shoeing, it will often happen that comparatively worthless animals are made able to perform their work tolerably well.

In the early stage of the disease, before the deposit has taken place, those remedies which allay local inflammation should be used, and nothing is better in the summer-time than showering with cold water; in cold weather warm fomentations should be used. After the acute inflammation has subsided, a blister may be applied with advantage, and a run on soft pasture given for a couple of months or so, will be of great benefit. In those cases where the deposit has already formed, the union of the bones is the object sought for, and to assist nature in doing this, rest should be given, by placing the animal in a comfortable loose box, and then applying such remedies as blisters, or sometimes firing has a very beneficial effect when blisters fail. The great objection to firing is that it generally leaves a permanent blemish, but if it is properly done this need not be unsightly. In some cases, which resist all other forms of treatment, the operation of newrotomy is followed by very beneficial results.

Mr. Palmer: Are there not valuable liniments for spavin?

Dr. Grange: Yes, anything that will cause a blister, like cantharides, is good.

Mr. ——: Would you recommend firing irons?

Dr. Grange: It sometimes does good, but it makes a permanent blemish, and its service can be rendered by less severe means.

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Mr. Blank: What is curb spavin?

Dr. Grange: Curb is not the same as bone spavin. Curb is a rupture of the ligaments on the back of the leg. With curb, horses travel pretty freely on first leaving the stable, but after a few miles show lameness, which increases.

Mr. Dillenbeck: Should splint be regarded as unsoundness, from a commercial point of view?

Prof. Grange: Not as a general rule, because usually it does not interfere with the animal's general usefulness, though where the disease is situated so as to affect the motion of the knee joint then it is decidedly unsoundness. Sometimes, when a splint is forming, it causes lameness and of course then it should be regarded as unsoundness.

Mr. Rolston: When the stifle comes out, is there any remedy?

Prof. Grange: Yes, there is a remedy for the condition called stifled; it is nothing more than a dislocation of a bone which corresponds to the knee-cap of a man, and called the patella,—when it slips out of joint it can be put back again by a person understanding the anatomy of the parts, or by any one for that matter, if they proceed in a proper manner; but of course a person having a knowledge of the anatomy of the joint will have much advantage in reducing the dislocation over one who does not. Sometimes it is a pretty difficult matter to return the displaced bone, but I have always found in those cases which were difficult to reduce, that the dislocation was less liable to re-occur; it is those cases where the bone slips in and out upon the slightest provocation that give the most trouble in the long run.

Question: Does it require an expert to treat a case of dislocation of the stifle bone?

Prof. Grange: No, not always; no more than it requires an expert to treat a case of dislocation of the shoulder in a man.

Dr. Bradford made some very interesting remarks with reference to the similarity between the diseases described by Prof. Grange and those of the bones of a man, and asked if they might be considered hereditary, or was this only a theory.

Prof. Grange stated that, from his observation and independently of the opinion of others, he would consider some of the diseases of the bones of the lower animals to be the result of hereditary taint, either from the style of conformation transmitted from parent to offspring, or other circumstance difficult to explain, and could call to mind several instances where colts were affected with bone diseases before they had ever done a day's work, or been subjected to the influence of the exciting cause of such diseases.

Question: What causes contraction of the hoof?

Prof. Grange: To enter fully into the causes of contraction of the hoof would, I am afraid, occupy a good deal more time than we have at our disposal, but I will state that I regard the condition as the result and not the cause of the disease, and find that in the majority of instances it is the result of a complaint usually called navicular disease or coffin-joint lameness, during which the internal structure of the foot wastes away, and the hoof, to accommodate itself to circumstances, falls in, as it were, giving it that appearance often called hoof-bound. The lameness occasioned by it can generally be overcome by certain lines of treatment, but I look upon the disease as of a very serious nature under almost any circumstances. To

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cure the lameness it is sometimes necessary to take out a portion of the nerves supplying the foot.

Mr. Heath: What is the cause of lumps breaking out suddenly all over a horse?

Prof. Grange: This is a disease called urticaria or nettle rash, and I believe is the result of derangement of the stomach or some part of the alimentary canal. It is not dangerous and can usually be overcome by a little opening medicine. We have some other diseases, though, where certain parts of the external surface of the body are affected by the presence of lumps, but there are so many of these skin diseases that I could hardly answer the question in a general way, as the symptoms differ somewhat in the individual cases. I may say though that with the other diseases the lumps do not come and go as quickly as they do with nettle rash.

Mr. King: What is the cause of spring halt, and how can it be cured?

Prof. Grange: The immediate cause cannot always be determined, though veterinarians think it is often caused by pressure upon the nerves supplying the hind leg. It is incurable in many instances, though I think it may be modified to a considerable degree by regular exercise and proper attention to the general health of the animal.

HORSE RAISING.

BY MR. LEVANT STRONG.

Read at Centreville, February 19, 1889.

MR. PRESIDENT, LADIES AND GENTLEMEN: In raising colts we have always had better success where the mother has had plenty of exercise before foaling. If you do not have work for them, turn them out in the yard during the day. We usually winter our brood mares on four ears of corn, or its equivalent in oats, twice a day, with straw night and morning in the stable, with a few stalks during the day in the yard. We always work them in the spring, commencing with part of a day at a time in a three-horse team, and soon work them steadily all day. Of course a great deal of care and judgment is necessary not to overwork, nor should we allow any one to jerk, or misuse them in any way. Gentle treatment is *always* better with horses, and with mares in foal it becomes a necessity if you would avoid injuring them. They should be worked steadily up to the time of foaling if possible. This is quite essential for a number of reasons. The mother is stronger and is more apt to be in good physical condition. The colt also is more apt to be strong and healthy, and better able to take care of himself. The mother should be allowed to rest about two weeks after foaling, when if she gets along nicely, she can be put at light work on the farm. When the mother is at work the colt should be kept in the stable, both in the interest of the mother, the colt, and the temper of the man who works the team. You should be sure and have the feed-box in your stable low enough, and large enough, so that the colt can eat with its mother, as the colt will learn to eat grain much quicker than he would if fed alone. As soon as the colt will eat oats, he should be fed a few when the mother is taken out of the stable to work; should commence by feeding him a handful, and gradually increasing the quantity.

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The colt should be weaned when about five months old, and it is essential at this time that you should have a roomy box-stall to keep him in. I would say in this connection, that you will find several box-stalls in your horse barn excellent things to have, as they make a good place to turn a horse that is sick or lame, or if he is not at work it will be much to his advantage to be loose in a stall. The colt should be halter-broke and handled the first winter as it can be done much easier now than when he is older and stronger. We usually feed oats the first winter, or sometimes feed two parts oats and one of bran. The right age to commence working colts depends largely on the colt. Some are as well developed and as able to work at two years of age as others are at three. As a general rule, however, they should not be worked till three years of age. If possible, they should be given light farm work the first year, as there is less danger both from overwork and accident. A great deal of patience is necessary in breaking colts. Most men expect too much of a colt, and think he should go just as well as an old horse the first time he is hitched up, and if he does not they punish him. This is all wrong, for you should remember that he has everything to learn. Two things are essential in breaking colts, and will apply equally well to breaking boys, and these are, gentleness and firmness. First try and make the colt understand what you want him to do, and then be sure and make him do it, if possible; but in all this you should exercise judgment, and not ask or expect him to do too much. It is said that the Arabs never strike or whip a horse, and they are very successful in the management of horses. There are many colts that never ought to be struck a blow with the whip, and there are others that it is almost impossible to successfully manage without punishing at times. Never punish a colt without good reason for believing that he understands what the punishment is for.

Study the disposition of the colt and you will find that no two have dispositions just alike. Just as two children will not have dispositions alike, so you can safely reason that the kind of treatment for one colt may not be just the thing for another. As a general rule gentle treatment makes gentle horses.

There will always be a demand for roadsters, draft and coach horses. The last class named, however, will probably come the nearest to what the farmer most needs for a general purpose horse. The man who would make horse-raising the most profitable must study the market to know which class there is a demand for.

I would breed Cleveland Bays of about 1,300 weight. We have young Normans.

Prof. Cook: I like the idea of box-stalls, and suggest wire gauze for windows to keep flies out. It would seem to me that oats and bran in the winter would be better for brood mares than corn.

Mr. Strong: So should I if I had oats.

Prof. Cook: I like best to have half of my colts come in the fall and half in spring, so that you will always have animals ready for work. If they were all to be at one season I would prefer fall to spring. As to breed, I think it a great mistake for farmers to choose the trotters. I am inclined to favor the Percherons.

Mr. Strong: There is always a demand for both heavy draft horses like Percherons and for general purpose horses like Cleveland Bays. We like to have colts come about the middle of May.

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Mr. Sharp: I would have three-fourths or more of my colts come in the fall, from September 1 to October 1, so that I can use the mare through seeding and leave her with the colt till March 1, by which time the colt has learned to eat hay and oats.

Mr. Simpson: The training of horses is not sufficiently appreciated by farmers. Ordinary horses in Michigan are easily scared so as to be uncontrollable. I have handled all sorts of horses, and with all have found the Rarey system of Yankee bridle, a long whip, combined with rewards and punishments, entirely effective, and very quickly so.

Mr. ———: Does Prof. Cook prefer oats and bran with straw to corn and straw for brood mares in winter?

Prof. Cook: I should prefer at least part oats to all corn with straw, as with only corn your colts are apt to be weak—lacking in bone structure.

Mr. Major: With ensilage, fall colts may do; without it, I should prefer spring colts.

Mr. Sharp: I feed corn, oats, hay and straw to a mare with a colt, and she gives plenty of milk and the colt does well.

HORSE BREEDING.

BY C. A. BLACKMAR.

Read Before he Farmers' Institute at Brooklyn, February 14, 1889.

I think there is no branch of farming that pays better at this day, or is likely to pay better for years to come, than the breeding of good horses. Last spring I had a pair of colts three and four years old, own brothers. Of course they were good ones; I don't raise anything else. I also had a pair of twin steers, three years old. They were very nice—as good stock as the colts. Last June I sold the steers for $135, which was all I could get for them. The four year old colt I sold for $200, which was about one-half of his value. If he improves with age and handling, as some of my colts have, he will bring from $500 to $900. The other colt, a better one, it is fair to suppose we will get $20(for. So you see in this case it will take about six head of steers to bring as much money as one pair of colts. And when we take into consideration the figures of the thoroughbred cattle sales for the year, in our State, the showing for the horned animals will not be improved.

Most of you know that many of our thoroughbred colts bring from $1,000 to $3,500, as in the case of Bell Boy, a two year old. The breeding of high priced horses—trotters if you please—is yet only in its infancy. We are fast establishing a reputation, even in the countries of Europe, for producing this class of horses, which will soon make us second to no State in the Union. To attain the best results in breeding good horses, we should make it a specialty. Then our business would be known and our reputation soon established. We would not then be obliged to run the country over peddling colts, but would have the buyers come to our own doors and give us paying prices. As examples of what can be done in this direction, I refer you to Dewey & Stewart, and Savage & Farnum of this State, Dunham and others of Illinois, who have made independent fortunes in the business. In order to succeed, we must breed from the best strains of blood available, and see particularly to the fact that our brood mares are sound in wind and limb, and of good disposition if possible.

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It costs us no more to raise a colt, from the time it is ten days old until four years of age, than it does to raise a steer. I feed no more grain to a colt than to a steer (I prefer to use equal parts in bulk of shelled corn, oats and bran).

I would say to those who work their brood mares, that if they would confine the colts to the barn they would save themselves much trouble and inconvenience, as well as benefiting the colt thereby. We do notallow our colts to follow whether we are going to the fields or to town. We have a strong gate hung on the stall and when the dam leaves the barn the colt is shut in. It soon learns to lie down and be quiet, if well bedded, until the mare is again brought in. It seems to me that this plan is better for all parties concerned.

Mr. Jno. Flint: The paper compares the prices of high priced horses to those of ordinary cattle. Cattle are often sold as high as $2,500 per head.

Mr. ——: The horse industry of Michigan is the greatest industry of the State; the value of the horses exceeding that of any other animals. Fine horses bring better prices than fine cattle, and scrub horses better prices than scrub cattle. The prospects of cattle-raising are looking down, while the prospects of horse-raising are looking up.

Dr. ——: It seems to me, Mr. Blackmar is running horse breeding too much in one direction. Trotters are good, but are not the only horse needed, and we should develop animals that can walk, or trot, or run, a horse that can haul our loads and fill the bill for a carriage horse. But one trotter in a hundred is good for anything as such. There is unlimited demand for fine carriage horses.

Pres. Willits: Few persons can, with success, breed trotters, but many of our farmers could breed and train draft or carriage horses successfully. I remember hearing it said that the Percheron stallion imported by Senator Chandler had increased the wealth of Ingham and Clinton counties $100,000.

Mr. ——: Jackson county does breed all kinds of horses, from mustangs to the best of draft animals, and yet the most sought for are 1,100 to 1,200 pounds, 16-hand high horses, from trotting stock, that any farmer can raise, and that will bring the most money and be the most generally useful both for farm and road use. We need action and we appreciate style.

Mr. Blackmar: I did not intend to state in my paper that I raised trotters.

Mr. ——: It seems necessary for us to raise general-purpose horses, though I think that if we could establish our market the draft horses would be most profitable for us.

Dr. Grange: My father imported several thoroughbreds from across the Atlantic, and found them admirable general-purpose horses. A few years later a neighbor imported some heavier horses, the Suffolk Punch, which had their day and were succeeded by the Clydesdales, which have been popular ever since, as the farmers find them less liable to injury and more profitable.

BREEDING.

BY DR. MANLY MILES, OF LANSING.

Report of an Address before the Farmers' Institute at Flint, January 30, 1889.

Competition in every line of human activity and the almost universal employment of machinery have so narrowed the margin of profit as to

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compel the saving of every possible fragment of value. Substances that in periods of greater abundance and an easier prosperity were heedlessly dumped out as waste, are now carefully reworked to preserve whatever residue of value may still be in them. For example, petroleum refineries now produce from former refuse products, dyes that are supplanting madder and other costly dye stuffs in the markets of the world.

Just as this petroleum waste interferes with the madder business, so each improvement in production displaces and renders practically worthless the capital invested in the older and more costly methods. Thus, the Suez canal, by shortening the route to India so much that steamers could carry enough coal for the entire trip, made the steam voyage cheaper than the sailing voyage, and thereby practically destroyed at one stroke the chief value of the great fleet of sailing craft formerly employed in that trade. In little more than three years later, further improvements in marine engines made these steamers themselves behind the times, to be superseded by the more economical new models.

So in cotton mills; it is in the latest improvement of machinery, whereby the last one-tenth of a cent per yard is saved, that the whole margin of profit lies, and to use the older machinery is more costly than to sell it for old iron.

Such a degree of specialization of occupations as takes place in most lines of manufacturing is neither practicable nor even desirable on the farm.

For there, this very need of saving and working over the residues requires that stock should be raised on the same farm that grows the stock food so that the residue, the manure, may go back for the fertilization of the soil.

The real test of the value of any animal considered as a productive machine is the return that it makes for food consumed, and on this basis the scrub is an antiquated machine and must give place to the later improvements.

Do you ask what will become of the breeders when all the scrubs have been turned into beef? Just what has become of the inventors after their improvements have been universally adopted. They will continue to develop yet further betterments and these improvements will be as eagerly sought as former ones have been.

The question is often asked me as to the relative merits of the different breeds. You might as well ask what are the relative merits of the apple and the pear. Each is for a different purpose, and each breeder should determine his choice upon his needs; but in no case choose a breed which he is prejudiced against, for it will be impossible for him to appreciate and develop its strong points.

The principles of breeding are primarily two—heredity and variation.

Heredity is the transmission of characters from parents to offspring, and by means of it alone you are only able to fix characters which you already have. There is nothing new in it. It is the principle of conservatism.

Variation is change. It is that wherein the individual differs from its ancestry, and often seems as though it had no other cause for being than merely for the sake of change.

Heredity is the impress of all the characteristics of all ancestors from the beginning, and our business is to so combine different elements as to make prominent what we want, and to practically make latent all undesirable characteristics.

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How shall we go about it to fix and render permanent or prominent any particular feature, or set of features, in a breed? Simply by selecting ancestors in whom those particular features appear prominently.

The old rule, "breed from the best," is defective, because it does not set before the mind any definite standard of what is "best." It may be one day size, another beauty, now productiveness, and again some other standard.

Your ideal of what you want should be a fixed one, so that all your efforts may tend to the same end.

In all talk about breeding we hear a good deal said about pedigree. Now just what is meant by this word? Certainly we do not mean merely a showy piece of parchment. No, we mean ancestry; but there is choice in ancestry, and there is choice even in choice ancestry.

To be of value a line of ancestry should consistently tend to a specific purpose; otherwise, though containing the most famous names known to breeders, and even though it has not a single poor name on the list, yet it may be but a very small recommendation, for the very good reason that its influences may be so arranged as to be continually defeating and counteracting themselves.

So fix your ideal, and make all your efforts tend in the direction of that ideal. Do not allow yourself to be drawn aside by any desire to have representatives of all sorts of families.

People sometimes speak of a "tendency to variation" as though it were an occult and inexplicable thing. There never was any effect, whether in the variation of animals or in any other direction, without an adequate cause. Variations in animals are the legitimate and natural effect of the conditions under which the animals are developed. Climate, food, habits—these are the causes of variation. With us stabling, acting as a modification of the influence of climate, is an important element in the matter of variation.

The more an animal has been developed by the influence of special conditions away from its original type, the more susceptible it is to further change. These changes are all efforts on the part of the system of the animal or breed to adjust itself to the conditions in which it is placed, and the expression, "survival of the fittest," merely means that those animals whose systems have most perfectly adapted themselves to the conditions of a given locality will live in that locality while others, less well adapted to it die, or are crowded out by their better equipped competitors.

It is thus that local varieties originate, and it is by the same principles that breeds are improved, and the same influences that produce a breed or variety continue to act all the time.

If you buy an animal to your liking, you must remember that it is the product of certain special and often highly artificial influences, and if you subject it to directly contrary conditions and influences you must not be surprised if the qualities that you particularly admired lessen or even entirely disappear in itself or its offspring.

There is another principle in breeding, called the correlation of parts. This means that the relation between the different parts of the animal system is so balanced that no changes in the animal can be made without other balancing changes also appearing simultaneously with it, so that you need to beware lest gains in one direction may be more than offset by the losses in

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others. * * * * * Hamilton, the great Vermont sheep breeder, said that of his own ram lambs there was not more than one out of three hundred that he would use in his own flock; which merely means that he had developed his flock to such a hight point that even of the rams of his own breeding there was not more than one in three hundred that could better the flock.

It will readily be seen that there is no short formula by which to insure wealth or success in this line of effort. It requires good judgment, taste, skill, patience; indeed you can bring into play all the good qualities that you possess and you will find them all of use in making you a successful cattle breeder.

Mr. Geo. W. Stuart: Does in and in breeding, or line breeding, as it is sometimes called, necessarily result in weakness?

Dr. Miles: In and in breeding has about it certain possibilities of evil, and yet there has never been any considerable improvement of live stock made without it. People are sometimes hurt by the railroad, and nevertheless we continue to use railroads and probably always will. Do you ask why is in and in breeding necessary? Because, in order to fix similarity of characters, you are often reduced to the necessity of taking relatives in order to get similars. In and in breeding is not of itself bad, but it does serve to intensify characteristics, and if these are bad then you will suffer.

THE RELATION OF BREED TO MILK AND BEEF PRODUTION.

BY PROF. SAMUEL JOHNSON, OF MICHIGAN AGRICULTURAL COLLEGE.

Paper Presented at the Fourth Annual Meeting of the Holstein-Friesian Association of America, in New York, March 20, 1889.

Breed is the term in common use by which we designate a group of animals, distinguished by qualities not common to other groups of the same species. Breed characteristics may be few or many. To illustrate, color alone is the one characteristic that distinguishes the Essex from the Suffolk breed of swine. In all other respects the two breeds are identical. The Sussex breed of cattle differ from the Devon only in being of larger size, according to our best authorities, and I believe there are examples where the distinction between the breeds has been, in fact, in name only. Usually, however, these points of difference are more numerous and pronounced, embracing color, form, size, temperament and uses. Indeed, a trained observer will, in comparing the animals of distinct breeds, note points of difference in almost every external characteristic. To his eye, these externals indicate differences of internal organism that have to do with with the amount of food consumed, the ability to assimilate and digest such amount as shall return most profit in a certain line of products,—in short, the utilization of food in production. These breed characteristics are sometimes the product of natural causes. More frequently man's agency is apparent in the changes observed, and these are in line with the universally admitted law in all animal life, the tendency to adapt itself to its environment.

The habitat of animals has much to do with their peculiarities of development. Upon soil conditions depend the kind and amount of food produced, and so soils indirectly have much to do with the developing and establishing of breed characteristics. Fertile lands, level or moderately rolling,

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develop our larger, early maturing breeds. Rich pastures, where full food supply can be obtained without much effort, develop large animals. On the other hand, sparse pastures on uneven, hilly or mountainous land tend to decrease size, and so we find most of our small breeds have had their origin on lands of uneven or barren character.

Climate, too, plays no unimportant part in producing breed characteristics. Those breeds most highly prized for their economic values are natives of the temperate zones. These are all natural conditions and affect animals prior to as well as after their domestication. And yet while each and all of these factors have had great influence in molding into form our numerous breeds, and have more or less to do with the improvement or deterioration of their peculiar characteristics, it must be admitted that to skillful breeding and feeding we are indebted most largely for those breeds whose value for practical uses are most positively decided.

It then follows that the relation of breeds to milk or beef production, or to any line of development, is not a fixed, but under certain limitations a variable one, dependent upon the continuance of the causes that have contributed, by intensifying its distinguishing characteristics, to its individuality.

HOLSTEIN-FRIESIAN CATTLE.

With these brief references to breeds, and the agencies by which they have been developed, let me allude to the history of the breed of cattle in which you are most directly interested, and see how far these references apply. The home of the Holstein-Friesian breed, so far as we can trace its origin, was on the flats of North Holland and Friesland, noted for their fertility from a very early period. Every condition of soil and climate were calculated to develop a large, hardy breed of cattle. And when we remember that the sturdy Hollanders were the pioneers in dairy husbandry, and that their dairy products in amount and quality have never been equaled by any other people on the same area, we have the reason of their zeal and effort to perfect a breed of cattle suited to their special industry. A soil of great natural fertility, especially adapted to the production of the most valuable grasses and forage crops, has been made more fertile, sure and productive by the added benefits of irrigation and heavy manuring. It is to their credit that as early, if not before any other people, the Hollanders identified themselves with the cultivation of tame grasses and the clovers, which have proved potent agents in the developing of this breed of cattle that has been famous for dairy qualities for centuries. In short, the Holstein-Friesian breed of cattle is the product of most favorable natural conditions. Soil and climate have contributed to the furthest limit in their development, and the Dutch farmers, with more far-reaching knowledge perhaps than those of any other nationality, have weighed the advantages of dairying in maintaining fertility and returning adequate rewards for capital and labor invested. To them the typical dairy cow has been the image of profit. To develop in her offspring those qualities that should add to her value for this particular purpose has been their study not for one, but many centuries. Can we doubt the strength of heredity thus acquired and intensified through successive generations; under natural conditions so favorable, coupled with the studious efforts of the breeders by careful selections to attain their ideal of perfection?

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That ideal being the animal that could transmute the products of their fields into the largest amount of milk and its products.

I think there can be no question of the dairy characteristics of the Holstein-Friesian breed as thus evolved in the land to whose fame and wealth they have so largely contributed. It has remained for American skill, however, to take the choicest specimens that could be found in Holland, and not only to equal but eclipse the largest recorded production in the home country, on American soil and under American management. But bear in mind that these results have only been realized when the American breeder has taken for his ideal that which has enabled his over-the-sea contemporary to achieve success, viz: the development of the dairy cow, the intensifying of qualities valuable for this special purpose.

FUTURE DEVELOPMENT.

But what of the future? Breeds of cattle, under natural or artificial conditions, do not stand still. The unalterable law of advance or retrograde applies here as forcibly as in any other domain of man's effort.

Breed characteristics, while they may not be entirely eliminated, may be very greatly modified by change of conditions and management, by the endeavor to utilize the animal in other directions than those in which it has been improved and developed. To illustrate, we may secure delicacy, fineness of bone and low per cent of offal at the expense of size, vigor and toughness. We may breed so as to sacrifice milking qualities for beef production. We may disperse, weaken and modify those characteristics that have become hereditary only as the product of years of persistent and wisely-directed effort on the part of the breeder. It takes a long time to establish breed characteristics so that we can depend on their being transmitted to offspring. A very short time in a course of opposite, or antagonistic procedure, will vitiate very greatly, almost destroy, these characteristics.

And so to my mind the future success of the breed, the holding of its present place and achieving greater victories depends on your working on the same line, to secure in more perfect degree the realization of the ideal of your Dutch predecessors, viz., the best dairy breed of cattle. If you have it today, be thankful, but remember that only eternal vigilance, a continuance in the same line, with the same object that has brought the breed to its present position kept ever in view, can maintain, perpetuate and add to its excellence.

BEEF QUALITIES SECONDARY.

Do not be distracted by any clamor that the breed is wanting in beef quality. That is a matter of very little consequence when compared with its value for the dairy. Don't be persuaded to displace your ideal cow for the dairy for a myth, an uncertainty. Don't follow in the lead of some unthinking enthusiasts, who are full of wild theories which invariably side-track them a good distance from the home station, where practical results are realized. Your ideal cow has not sprung up in a night, nor come forth full panoplied in her most valuable qualities from airy nothingness. Avail yourselves of all the knowledge and science of this ultra scientific age. It may help you in methods and management, in your efforts to improve the

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ideal; but if any success is attained it will be because you study and plod along the same lines of practice adopted by your predecessors over the sea, because you have the same object in view for a guiding star, an inspiration.

What is science in breeding cattle but the application of those principles that long years of observation and experience in actual breeding have demonstrated to be of general application? It is the right use of what is known on this subject. Not the counterfeit wisdom which is too often apparent in the advocacy of unknown if not unknowable theories. With a profound respect for every ray of light, for every grain of knowledge that modern science can contribute to us in our labors as breeders, we must not forget that success will only crown our efforts when we utilize our knowledge by applying it in common sense ways along the lines where the best practice of the wisest doers in the past has marked the lines of real advance in breeding. An English writer has recently said with much truth, that great dairy properties may be present where there is also a tendency to rapid and abundant flesh-making; that you have, for instance, an excellent dairy cow which, when fed off, at least makes a profitable return to the grazers and pleases the butcher and his customers besides. Such animals indeed are common enough in districts where breeding for general purposes is skillfully practiced, but they do not supply evidence contradictory to the necessity of sticking to one object if you want perfection in any one property. They rather suggest what may be done by repeated blendings of properties which cannot permanently co-exist without more or less impairing one another. They are not, it is here suggested, examples of permanent results, but of results which may be obtained in perpetuity by fresh combinations."

So far as the Holstein-Friesian breed is considered for beef production, we should not forget that this quality has been secondary in importance ever since the breed had a history. I have no hesitancy in saying that in my opinion the future success of the breed depends upon keeping this quality in subjection to the dairy qualities.

It will not be forgotten by those conversant with the history of the early Shorthorns, that the Teeswater breed, as they were called in an early day in Yorkshire, England, were noted for dairy qualities, and while some of the descendants of this old stock have been so wisely bred that this quality of milk production has not been lost, in far too many cases the desire for symmetry, beef quality and early maturity has led to a course of breeding that has sacrificed this quality in good part. That Shorthorn breeders realize that such action has not been altogether wise is evident from the official action of the State and National organizations on this subject.

There is no question of the quick growing qualities of the Holstein-Friesian breed. I have had some opportunity of comparing their growth with the so-called beef breeds, under exactly the same conditions, and I think that they will make as many pounds in the same time as any other breed. They lack the early maturing qualities, the large development in the places where our highest priced cuts are secured, the early ripeness and finish which are prime characteristics of the beef breeds; characteristics, remember, that may have been secured through generations of breeding for this particular development, and at a corresponding loss, invariably, of dairy qualities.

And so, while I am forced to the conclusion that while they are quick growers, they lack in the qualities that will enable them to compete in beef rings with the earlier maturing breeds. I must say, in all honesty, that I believe that

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the standing of the breed in our beef markets today is not what its actual merits entitle it to; and I beg your indulgence while I suggest what seems to me to have contributed largely to this prejudice, and what I would suggest in the way of a remedy. Prejudice is very likely to be the child of ignorance. It is the lack of facts that very often leads to erroneous impressions, to false conclusions.

There has been such a demand for your pure bred cattle that only a few have found their way to the shambles, hardly enough to enable the dealers in our principal markets to grade them in value properly; and without knowing how or why, dealers invariably class them as very unsatisfactory animals for the markets.

Would it not be wise for Holstein-Friesian breeders to weed out more of the animals that are not up to the standard in their herds? More or less calves in all herds should be culled out. Sold as breeders they impair the reputation of the breed, lower the breed standard and the price of individuals. It is not good policy, from a financial standpoint. It does not add to the prestige of the breed.

ADVANCED REGISTRY.

I think at your last meeting your president suggested that it might be wise to adopt a rule providing that no bull calf should be eligible to registration except from a dam eligible to the advanced registry list. He thought it would be of advantage to the individual breeder as well as the association, to largely cut down the registry of bulls. If such a course of procedure were followed in every herd, we could soon place so many animals on the market that whatever of merit they have, as meat producers, would be known, and I am confident that much of this prejudice would be dissipated by a better knowledge of the edible qualities of the beef of this breed. In addition, by such a course, the higher and more valuable qualities of the breed, as dairy animals, would be strengthened.

This Association is to be congratulated on its action in establishing a system of advanced registry. You have been the first to take this action, the wisdom of which, in thus uniting well vouched and recorded performance with pedigree, commends itself to every thoughtful breeder. That your laudable example, with more or less modification, will sooner or later be followed by other cattle breeders' organizations I cannot doubt.

This is a questioning age. We scan traditions and claims in stock as well as other matters, and unless they are girt about with the facts that appeal to our practical sense we reject them. We do not have as many pedigree worshipers as formerly, or at least have wiser ones, and it is a good omen when breeders insist upon a standard of performance as the truest measure of value.

Pedigree is only the prophecy, the promise of value in a certain direction. Performance is the prophecy fulfilled, the most indisputable evidence of the ability of the animal to pay in current coin of the realm what is promised in its pedigree.

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ADDRESS BY PROF. SAMUEL JOHNSON,

PRESIDENT OF THE MICHIGAN SHORTHORN BREEDERS' ASSOCIATION.

Delivered at its Eighth Annual Meeting, in Lansing, December 20, 1888.

MEMBERS OF THE MICHIGAN SHORTHORN BREEDERS' ASSOCIATION, AND FRIENDS:

Another year of varied experience has passed and you have met at this annual gathering to compare notes; to speak, modestly of course, of your triumphs in breeding, showing and perhaps in selling the red, the white and the roans, the breed which represents to you more excellent and profitable qualities than any other.

Possibly some of us, probably not many of us but have met with some discouragements in our breeding of Shorthorns during the year. Our herds have not increased as rapidly as we had hoped, we have been disappointed in the gender of our produce; the red heifer calf we anticipated has proved to be a spotted bull, and our color-phobia has been shocked; we have not made as many sales as we had hoped to, and our range of prices may have suffered somewhat owing to the peculiar conditions of the market. You may have thought your experience was exceptional, but when you hear the story of the year from your brother breeders, you will see that it is very like your own, and so out of this narration of an experience and incident common to all who are in the business, we gather hope and courage for further effort in this our chosen pursuit.

WEEDING OUT.

The low prices at which good, well-bred Shorthorns are selling, make the present a most propitious time to weed out, from our herds, all animals that are not up to our standard of breeding and individual excellence. It will unquestionably be better for the herd and the business in general to send them to slaughter, rather than where they will be likely to disappoint the purchaser who buys them for breeding purposes.

This weeding out and grading of the herd needs to be done very judiciously, lest through the clatter of uncertain and frothy public opinion, falsely so called, or the caprices of fashion, you are persuaded to discard an animal or a family of proved merit that has made you money, for one that will not be likely to satisfy you when you are looking for produce and profit. Perhaps I am in error, but I cannot bring my judgment to acquiesce in what I believe is a dangerous heresy, viz: that it is wise for me to discard a family of Shorthorns that is satisfactory, so far as all essential and useful qualities are concerned, because forsooth some man with no more, perhaps less information than myself on Shorthorn topics, assumes to write unfashionable across the pedigree of my cattle.

CRAZE FOR YOUNG BULLS.

The custom of American breeders of discarding aged bulls and always buying young ones, is not, in my opinion, to be commended. Aged bulls, from three to six years old, that have demonstrated their value as breeders

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in the admitted quality and general excellence of their get, are sent to the shambles every year, while young animals who as getters have their record all to make, are selected to head our herds. It is a well accredited fact in Shorthorn history that many of the bulls most highly valued have not won their honors as young ones; but in mature years when ocular proof of their high quality and hereditary power was manifest in a large number of produce of uniform excellence.

While we are not inclined to question the theory that the offspring of mature animals, everything else being equal, will in the nature of things be superior to those produced by immature parents, breeders do not emphasise their faith in this law by their practice.

English breeders are wiser in this respect, and aged bulls that have proved merit, are retained to an advanced age with great profit to the herd. Can we not learn a valuable lesson from this practice of English breeders? * *

NEED OF FODDER CROPS.

Our herds have been free from contagious diseases during the year; and while the long continued drought has seriously affected our pastures, and many herds have come to winter quarters somewhat thinner in flesh than usual, this loss will be repaired if there is an abundance of good forage for them in winter quarters. You will pardon me, however, if I refer again to the advantage of having a supply of fodder corn, to supplement the short pastures that seem quite likely to come to us every season. There can be no question, I think, about the economy of keeping our breeding herds in good thriving condition. There is an absolute loss when they are allowed to run down in flesh, and more so in the fall of the year than at any other season. The old adage that "An animal in good flesh in November is half wintered," has in it more than a moiety of truth.

ENSILAGE.

The value of ensilage as an auxiliary winter food is coming to be more and more fully appreciated by stockmen, in all parts of the country. After some years of experience I have no hesitation in saying that every Shorthorn breeder will do well to give attention to this economical method of preserving fodder. One winter's feeding of the well preserved contents of a good silo—corn or clover—to your stock will convert the most doubting Thomas among you into a firm believer in the system.

MEMBERSHIPS.

The fifth article of our constitution provides that "Any person may become a member of this association by subscribing to this constitution and paying the sum of one dollar into the treasury annually."

This is construed to mean membership only for one year, I think our Secretary has called your attention to this matter at some previous meeting. Would it not be well to provide that the membership shall be permanent, so that the annual dues might be expected from all who have ever become members, until their withdrawal? I believe such a change would be of advantage in replenishing our treasury and also in attaching our members

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more closely to this organization, which has for its sole object the promotion of the interests of its members as Shorthorn breeders.

I recommend to your consideration this proposed change, as calculated to subserve the best interests of the association.

LEGISLATION.

I have noticed that the Grange, the State Horticultural Society and kindred organizations, at their annual meetings preceding legislative sessions, appoint a committee to look after their interests in legislation. This seems to me eminently wise. There is strength in organized combined effort. Organizations have voice, influence, can secure desired action. I therefore suggest the appointment of such a committee by this association. Surely the improved live stock interests of Michigan are second to no other, and the representatives of these interests may justly and with great propriety demand recognition, not only in legislation but also in the filling of the Boards of Control which represent agricultural interests in our State.

Quite a number of sales have been held by members of this Association during the year. While prices have ruled low, I think the averages realized will compare favorably with those reported from other States.

SALES.

The dispersion of the Rigdon Huston herd on the 21st and 22d of November, at Dexter Park, Chicago, was a marked event in the Shorthorn annals of the year. We are all proud of the fact that in the close competition for the plums of this herd, our breeders were at the front, and four Airdrie Duchesses and a Duke, as well as a number of other well bred ones, were secured for Michigan. For Michigan did I say? Aye, for the enterprise and pluck of her sons in any department of legitimate effort are justly the pride and heritage of the State. We congratulate each and all of the buyers of this State on their purchases, and sincerely hope that they will prove a pleasure and profit to their owners, and add to the prestige of Shorthorns in Michigan. The number of Duchesses and Grand Duchesses now in the hands of Michigan breeders must almost if not quite equal the number to be found in any State of the Union; while the individual quality of the members of this famous family owned here, is conceded by those most capable of judging, to be unexcelled.

DAIRY SHORTHORNS.

The action of the National Shorthorn Breeders' Association favoring the creation of a special class for dairy Shorthorns at our fairs, I think will be conceded as timely and of much importance in maintaining the supremacy as the all round animal for which the Shorthorn has been so long famous. The resolutions adopted were as follows:

WHEREAS, An effort is now in progress for the purpose of holding a National Dairy Fair in the city of Chicago during the fall of 1889, having for its object a practical exemplification of all dairy interests, including dairy cattle, dairy products, implements and methods, and

WHEREAS, This Association acknowledges the importance of the dairy industry, be it *Resolved*, That this Association heartily indorses such an enterprise, and does appoint a delegate or committee to represent them at the meeting which will be held for final organization of the National Dairy Fair Association; and be it further

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Resolved, That the Directors of this Association be requested to offer a premium for the best milch herd of Shorthorn cows at such a fair.

Upon which as the committee, above referred to, E. E. Chester, Ill., J. S. Latimer, Ill., and S. Lamoine, Pa., were appointed. The second resolution as reported by the executive committee was:

Resolved, That the executive committee be authorized to arrange with the State agricultural societies or fairs of such States as have considerable dairy interests to pay from funds of the Association a sum not exceeding $250 per annum to any one society, to be paid as premiums for a Shorthorn class for the production of milk and butter, provided that Shorthorns be permitted by such societies to contest for sweepstakes premium with other dairy herds.

I would suggest, in this connection, that this Association provide for the appointment of a committee to confer with the executive board of the State Agricultural Society at its coming meeting in January to secure such changes in the premium list as may be necessary to enable the breeders of our State to avail themselves of these offered prizes of the National Association.

A year ago I called your attention at some length to what I believed to be the mistaken policy of many Shorthorn breeders in making no effort to retain or improve the milking quality of their herds. "I am of the same opinion still," and hail this action of the National Association as an advance in the right direction.

FAIRS.

At our State and district fairs some few very good Shorthorns were exhibited in the fat cattle classes, but the display was not at all commensurate with the magnitude of this interest in Michigan. Fairly liberal premiums were offered by the various societies. The West Michigan and Ionia County Fair Association offered special premiums in addition, through the enterprise and liberality of some of their leading breeders. Sufficient inducements, one would suppose, to have brought out a large class and sharp competition.

FATTING STEERS.

At the fat stock show Mr. Smith, of Somerset, exhibited three head, the college two, and Mr. Townley, of Parma, some six head of very good steers. I believe it would be good policy for most Shorthorn breeders in Michigan to steer two or three good calves every season and see what you can make of them as feeders. A good, well-formed, even-covered steer that has made good growth and has real quality, demonstrates far better to your customer the rare feeding qualities of your sires and dams than you can do it by word of mouth. And I do not wish to be understood as intimating either that the members of this organization are lacking in the persuasive powers that bring out the good points of their animals for the benefit of a prospective customer.

DRESSED-BEEF MONOPOLY.

We hear perhaps more frequently than ever of the low price of cattle, that there is little demand for beef cattle in our local markets, and that the "big four" and the ranchmen of the far West have ruined, practically, the business of cattle breeding and feeding for Michigan farmers past remedy. I am not averse to limiting the privileges and power of those who seek to

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monopolize the cattle markets of the country. I heartily indorse what I believe embodies the true American spirit on this question, that the greatest good to the greatest number can only be secured by the regulation, if not the suppression, of monopolies.

I quote from one of the most competent and candid authorities in this country, C. C. Nourse, of Des Moines, Iowa, who, in a recent address on this subject, said:

"The present price of beef cattle is a matter of concern to every breeder of fine stock. We cannot expect stock-raisers to expend money or have money to expend in improving cattle so long as the business of raising stock for consumption is unremunerative. When great capitalists in Chicago inaugurated the dressed beef trade, the producers of the Northwest had reason to believe that the producer would be permitted to share in the profit made, by what would thereby be saved in transportation. The dressed-beef trade has increased to an enormous extent, and the railroad companies have recognized the propriety of adjusting their freights on dressed beef upon a reasonably equitable basis. But the producer has seen the prices go lower than ever. The testimony given before the congressional committee, recently in session in the city of St. Louis, is to the effect that eastern consumers are paying the same price for beef that they did when cattle in the Chicago market commanded twenty-five to forty per cent more than they are now bringing. The charge is made, and it would seem with too much reason, that a syndicate of buyers and packers exists at Chicago that is controlling the purchase of cattle and the sale of dressed beef, dictating absolutely what the producers shall receive on the one hand and what the consumers shall pay on the other. By the common law it was a crime to engross any commodity, especially any victuals, with intent to sell at an unreasonable price. Mr. Bishop, in his standard work upon criminal law, after treating of this crime, says: 'It is plain that he who uses the power which money or credit gives him to play a prank like this upon the community is an enemy to the race, and is as deserving of punishment as the thief or highway robber. The combination of capital with a view to destroy competition and plunder the public is the curse of the times. The farmers and producers of breadstuffs and meats are powerless in the hands of such combinations. The consumer is in the same helpless condition. The law must deal with such combinations as with all other conspiracies against society and human rights."

COMPETITION OF SCRUBS.

But let us look at another phase of this question. I appeal to the observation and experience of the practical cattle men before me to answer this question. It is not true that every fall, say through November and December, a lot of thriftless farmers with poor stock, poor in flesh as well as in breeding, push it upon the market at any price? The supply is large, the demand small for that class of cattle, and they are sold for a tithe of what it cost their owners to raise them. But mark you, they were "scrub" cattle forced on the market when there was no demand. It always has been so. It will be so for many years to come. Look at the other side. Is there a man in this audience who has ever fed well bred or high grade Shorthorns, put them in good shape, made a prime lot, who has ever failed to find a ready market for them some time between February and June, at a price

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ranging from four and one-half to six cents per pound and paying him a reasonably fair return for food and care? It is the "scrub" cattle that affect these farmers most directly. Their chief foes are in their own barnyards.

While we do all we can to secure needed State and National legislation to remedy the exactions of strong and greedy corporations, such legislation is likely to be delayed. I suggest that a little personal legislation may secure more immediate relief. If the farmers will pass a bill to banish the "scrubs" from their premises, to keep fewer cattle and care for them better, and give it immediate effect, they will secure some relief through their own efforts in a field where they have full control—relief that may perchance be long deferred through, oftentimes, the slow and mazy uncertainties of legal enactment.

THE SHORTHORN FOR THE AVERAGE FARMER.

BY HON. WM. BALL OF HAMBURG.

Portions of an Address Before the Farmers' Institute, at Flint, January 30, 1889.

* * * The scrub (the curse of the country) which disgraces the fields and barn-yards of the farmers of this, as well as other counties in this State, should be banished from the land as speedily as possible. It has no place or right on a well regulated and well conducted farm or among the good stock of the country. If those who grow this kind of stock will keep a debit and credit account of the cost of raising, and the returns they bring when disposed of, the balance will will be found on the wrong side of the ledger. No one can say truthfully, at the present time, when nearly all classes of improved stock are so cheap, that he is unable to own them. If he keeps stock at all he cannot afford to own any other, for the scrub is a source of loss to the owner, to say nothing of the humiliation of having them around. Good registered stock of all kinds is so cheap that it can be bought and bred and a profit made from either beef, milk, mutton, wool or pork, to say nothing of the advance on a good stock animal. The farmer raises grain and breeds stock for the profit he thinks or knows there is in it. The most profitable cow for the farmer to raise is the cow that will give the greatest amount of good, rich milk, and when through bringing calves and giving milk, will most readily make the largest amount of good beef in the shortest space of time, and with the least expense. The ideal cow should be what is termed the general purpose cow. Beef is the final end of all cattle, and the block is the umpire as to quality and quantity. The pail and the churn must settle the dairy qualities of all cattle. As the farm requires both the dairy and beef qualities, the best combination of the two requirements must necessarily be the best animal for the average farmer.

From long observation and considerable experience, I have no hesitancy in giving the post of honor to the Shorthorn. I make no war on any other breed. All are good, and in the direction of beef alone, the Hereford, so plentiful in this locality, is a strong rival. Not every Shorthorn has the milking quality as well developed as it should be, for beef, of late years, has been the main consideration, but more recently the dairy capabilities of cattle have had a good deal of consideration and the Shorthorn has been found capable of filling the requirements in a large degree, and where any especial

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attention has been given to milk production it has been well repaid. Hence I repeat, that for the average farmer there is no breed of cattle that can equal the red, white and roan. Assuming these statements to be true, how shall they be bred and how shall they be fed. The improvements in all classes of stock have been made by careful selection in mating, and in systematic and generous feeding, and good and proper care. And as this is true with reference to the improvements that have been made, it is equally true that such a course must still be carried on.

The law is immutable, that as improvement in breeding any class or breed of animals has been made by proper selection in mating and proper feeding and care through a long succession of trials and experiments, deterioration will as surely follow, and much more rapidly than the improvements were made, by careless selection and a disregard of all the laws and methods adopted in making the animals what they were. The same rules, the same or greater care in selection and methods of feeding and breeding must be observed as formerly in order to still make improvement, or even to hold that which has already been made. There can be no trifling with these laws if the breeder expects to succeed.

If it is decided that Shorthorns are to be the choice, what families or classes of that breed shall be raised. There are many so-called families among the Shorthorns, but there is no especial difference among many of them. Some bring more money than others because they have been more carefully bred, both as to pedigree and individuality. That animal is best that more nearly fills the requirements of the breeder. Pedigree and individual excellence should accompany each other; both should be good. Fancy pedigrees and fancy prices should be used by those who are able to make up for losses in some other way than in breeding cattle. Taking the block as the test, that animal is best that furnishes the greatest amount of choice meat in the least given time with the least expense. Those Shorthorns which can show through their history and lineage the greatest results in this direction, with a strong tendency to transmit these desirable qualities regularly and surely to their offspring, are the most profitable for the average breeder. These characteristics are not confined to any particular family, hence the family name should have no particular bearing in selections made for real value. A good combination of beef producing qualities from a variety of these families will, in my judgment, prove of much value. As to pedigree affecting the quality of the cattle, I am strongly of the belief that the last five or six crosses are particularly essential in breeding. One of the best authorities on breeding says to a beginner, eschew fashion, and make utility the sole aim. He should buy cattle, not only good in themselves, but such as have come of good sorts through recent generations. Pedigree is of the utmost value to him; but he must take care to use it rightly. He must guard against attaching fictitious importance to names and reputations which may have been justified thirty or forty years ago.

He should certainly try and secure the benefit of such foundation, where recent management has been of the kind to maintain or improve the good qualities of past times. He must remember that the existing qualities of today and the past ten or fifteen years is a matter of prime importance, that the present or recent good qualities as shown in herds at the present day, if produced with skill and good judgment, are among the things to be considered, rather than the reputation of herds great in their day, but which may

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in the hands of less intelligent breeders have been injured, or at least not benefited. There are plenty of good Shorthorns, well bred, that are obtainable at a little advance over good grades, and every farmer in the State who raises cattle for beef and milk should possess them.

There is more profit in it, there is more pride in it, there is much more satisfaction in looking at and owning a good animal than a moderately good one, and *very* much more than in owning a scrub and throwing away feed and time to preserve life.

Beef will be eaten as long as people eat meat, and the better the quality the earlier it matures, the more money it brings and the more successful is the raiser. Some say that a good grade is as good as a thoroughbred for beef. That depends on how much it lacks of being a thoroughbred. So few thoroughbred steers or heifers are fattened that these statements need taking with a grain of allowance. Reasoning from analogy, if the grade is made better by having numerous crosses of the blood of the the thoroughbred in its veins, it follows that the improvement was made by such thoroughbreds, and it also follows that the grade which is inferior cannot be as good as the thoroughbred which is superior. No farmer of today can safely be indifferent to the waste of feed and time in raising inferior stock. It is said that the bull is half the herd. If so, how important that he should be a good one. In description he should be something as follows: The weight when at maturity and in good flesh should be 2,000 to 2,500 pouds. He should be red or roan in color. He should be a low, compact, meaty animal, and from a family of good milking qualities. He should stand squarely and firmly on a good, strong (not coarse) set of straight legs well set apart. His head should have a masculine appearance (not coarse) with a clear orange-colored muzzle, as free from dark spots as possible, broad between the eyes, with a finely formed horn, flattish but not too fine. It should be so placed upon a finely arched neck that the look should be commanding, and as the saying is "up there," without any effort on the part of the groom or caretaker. His look should be intelligent, and his disposition kind. He should be deep in the girth, full back of the shoulders, shoulder points smoothly covered. He should have a well sprung rib, broad back, full over the loin, broad, smooth hips, coupling well forward and straight from the top of the shoulder to the point where the tail leaves the body, which should be far enough so that it should drop in a vertical manner, with a nice bunch of long hair at the extremity. He should be well let down in the twist, low in flank and not paunchy. His hide should have moderate thickness, elasticity and flexibility, or in other words, he should be a good handler. He should be covered with a good, thick coat of long, silky hair, and be an easy keeper. He should not be over or under fed, nor injured by a lack of proper exercise. His treatment should be firm and kind. The cow should be equally good, but smaller, to a certain extent. She should be a perfect beef animal when fleshy, and a model dairy cow when in milk, besides being a good breeder.

I will say, in conclusion, that the object in this paper has been to try and show the superiority of thoroughbred and well bred stock over the poor, no bred stuff that infests the county. I have given my own choice of cattle, and my reasons therefor, as they appear to me. That improvement has been made by good judgment, good care, and that without these what was gained would be lost.

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The simple fact that a farmer receives a large crop of wheat or grass from year to year excites no special comment or interest because the sight of it is only for a few days or weeks and it goes to the manufacturer. But the farmer who also breeds and brings to perfection fine and valuable specimens of horses, cattle, sheep, swine and poultry in connection whith his choice crops of grain and hay becomes a man of consideration. He is visited in order that what he is doing may be seen by others. Methods of breeding and feeding are dicussed. Authorities on these subjects are consulted and a general interchange of thought is constantly going on to the advantage of all. Social habits are thus encouraged, farmers mingle more with each other at their farms and firesides, and those inside the house become much more interested than they could possibly be in the mere matter of grain raising. Boys and girls become interested because something is being done with which they have a growing interest, and when they have finished their school studies and return home, there is something there besides simply plowing, planting and digging, and the sensible, well educated boy will be quite inclined to try the reality of a well managed farm rather than chase fame and fortune in the already over-crowded professions or positions.

HEREFORD—BREEDING AND FEEDING.

BY DR. JAS. C. WILLSON, OF FLINT, JANUARY 30, 1889.

I was one of a party, with the late Senator Chandler, when he once visited the "Crapo farm" in Gaines. In conversation, to illustrate what "he knew about farming," he told a story which he applied to himself. He said Senator Sumner had made a long and eloquent speech in the Senate on finance, banks, banking, and our currency. After he got through he went around to Chandler and asked him how he liked his speech. He replied: "Oh! it sounded very well, it will read admirably in the newspapers; but my criticism of it is, that you don't know anything about the subject on which you talked."

I fear some of my more experienced and practical farmer friends in this convention may look on my effort to impart knowledge and instruction on the breeding and feeding of stock somewhat in the same light that Chandler did Sumner's speech on finance. But my connection with the management of the Crapo stock farm, for more than twenty years, has enabled me to store away a few facts and ideas in connection with stock raising, their breeding, care, and feeding, which I think may be useful to those who are planning to engage in the business.

The first and most important step in starting out is the selection of a thoroughbred sire. Whichever breed your fancy or experience may have led you to choose, in order to produce in the grade or cross-bred steers the beef qualities of the best specimens of that breed, you must get the best bull possible for your herd. Like begets like in breeding for beef, as it does for milk, butter, or bones. You cannot make a silk purse out of a sow's ear, no more can you breed and feed profitably, for beef, our native scrubs and scallawags, made up principally of head and horns, belly and bones. To breed beef cattle, for the shambles, at a profit, you must therefore not only have the best breed but also the best individuals of the breed for these purposes. "Aye," but I hear some one say, "I cannot afford to pay the price;

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they cost too much money for my purse." I say you cannot afford *not* to do it. You cannot afford to breed and feed steers until two years old and sell for $20 or $25 a head, while your neighbor, for the same outlay of labor and feed, gets $40 to $50 each for his. The struggle for existence, competency, wealth, between you and your neighbor, under these circumstances, becomes an unequal one, in which the fittest is sure to survive. This is no fancy sketch, for we have sold from the Crapo farm steers, at two years old, for $55 a head, and took in part payment from the man to whom we sold, a bunch of steers, picked up in this county, of the same age as ours (and the best he could find at the time, for he was a drover from Detroit), at $23 each. Our steers had not been housed or stall-fed. They had, however, run with their dams, when calves, until time of weaning in the fall, and they had open sheds, well bedded with straw, to lie under and feed in during stormy days in winter. These steers of ours were Hereford grades, but possibly the same favorable results might be obtained by some other beef breed. This experience is not exceptional with us—we have duplicated it many times in the last twenty-five years, with our Herefords. Did time and space permit, I could give you statistics of our sales, both in our own market, to our local butchers and cattle drovers, and also in Detroit, Buffalo and Albany, which any one curious to know will find published in the report of the Michigan Board of Agriculture for 1878, on page 214, in a paper read by me before the Farmers' Institue, held in this city that winter, entitled "Herefords vs. Shorthorns."

Unfortunately about that time, or a few years before, the demand from the ranchmen of the West for grade bulls became so great and such high prices prevailed, that we, with the crowd, were tempted to sell our annual crop of calves for the immediate profits then realized; but, in so doing, we aided in inflicting an irreparable injury on the business. From this costly experience every breeder and feeder of beef cattle, irrespective of breed, should learn a profitable lesson. *Never breed from a grade sire.* Were it not for the cupidity and stupidity of breeders, varying from and ignoring altogether this maxim, we would have today a more healthful and profitable market for our pure-blooded sires, and a very much greater improvement in the ranch cattle of the West.

Happily, the tide is now turned. Grades for stock purposes and as beef producers are no longer in demand. Only thoroughbreds are now sought after. This is as it should be, and it brings us back once more to the legitimate business of breeding and feeding grade steers for the butchers' block. This, by the way, is the final resting place of all cattle, and a large share of the profits in handling any breed must depend on their meat value in the butchers' stall.

My personal preference is well known to favor the Herefords, as being the best and most profitable beef cattle in the world. I have heretofore given my reasons for this belief in the article already referred to, and although expressed eleven years ago, the interval since then has only strengthened that opinion. I am not here, however, to urge the merits of any particular breed, but to state what I believe to be the true principles that ought to govern, in a general way, the breeding and feeding of cattle for beef. Of course, your selection will be from one of the distinctively beef breeds—Herefords, Shorthorns, Polled Angus or Sussex. These were the leading beef breeds at the recent fat stock show at Chicago, and their positions, or

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merits, in the order named. It is true that the Polled Angus steer "Dot" was awarded the sweepstakes prize in the ring as the best bullock of any age or breed at the show, but he failed when put to the test of the block, in the quality of the beef and the amount of dressed meat to the gross weight of carcass. The Herefords this year, as they uniformly have done in years past, both at Chicago and at the great Smith Field Show in England, carried off the prize in quality of beef, marbling of the lean with fat, and in the amount of dressed meat to the cwt. live weight, two of the butchered steers dressing 70 pounds to the cwt. That grand representative of his noble lineage, the Shorthorn steer "Chief Brant," stood a good second in quality of cuts, and in many other respects was fully equal to the best.

It was a grand sight when this noble and princely lot of well groomed cattle was led into the prize ring, for the judges to pass their opinion, and award the blue ribbon. Cruel, it seemed to me, that man should be obliged to shed such royal blood to satisfy his appetite.

These finished steers, for show purposes, are not produced by the general farmer, or by ordinary feeding, and I only speak of them to remind you of what can be done by careful selection and proper feeding.

"How can I make the most and best beef, in the shortest time, with the least expenditure of food and labor?" is the question the ordinary farmer asks and is interested in having answered. My reply is: Select a good breed to begin with. Cross with the best dams you can get. Have your calves come early. It is better to have your calves dropped in January than June, whether they are to be hand fed or dam fed. Keep adding to the calf from the day of its birth, until sold to the butcher. Never let him lose his kidney fat. Always keep pushing him ahead. After the first two weeks, if brought up by hand, feed skim milk or sour milk, five quarts a day, with hay or clover tea enough to make it twelve, with a few handfuls of ground feed (oats and corn) added. Keep them warm and clean, well rubbed and bedded, with abundance of pure water to drink. The water should always have the chill taken off in winter to insure the best results. Give them early cut, well cured clover hay between meals, with a ration of roots, mangels, bagas or carrots, daily. In the summer they should have good pasture, with plenty of good, wholesome, pure water to drink at all times when they choose to go to it.

The second winter they can be kept growing, and in good condition, on coarse fodder, as hay, corn stalks, straw, millet, with a daily ration of roots if you can spare them. Open sheds to lie under.

The third winter they ought to be fed unhusked corn stalks once a day, in the morning (followed by swine to pick up the leavings), a ration of roots at mid-day, and hay at night. Fed in this way, with open yards to run in, and open sheds to lie under and protect them from storms, with a good bite of pasture in the spring, for a few weeks before marketing, they will be ripe for the butcher's block, and will bring the top of the market, and pay a good profit to the farmer. There is scarcely a farmer in Genesee county but what could raise and turn off two, three or more such steers every year, and help, in this way, to enrich himself, besides aiding in supplying the home market with choice beef.

There is another plan which might be adopted by the farmers of this State and county in producing the best quality of beef at a profit. This is by keeping more work cattle on their farms instead of horse teams. For

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this purpose the Herefords are admirably adapted. They are quick and active in motion, good walkers, gentle in disposition, hardy in constitution, early in development, and make, when broken to the yoke, first-class work cattle.

By this plan steers can be kept until four or five years old, always in good flesh and made to gain from day to day, paying in part for their keep by work done on the farm; and when disposed of they will weigh sixteen to eighteen hundred pounds each and bring good prices for beef. The heifers and cows may be kept until five or six years old, rearing two or three calves before being beefed, when they will, if properly selected, weigh from twelve to fourteen hundred pounds and bring the highest market price. We have sold a great many such cows in our home market at five cents per pound live weight. For the small farmer this latter way of producing beef is most profitable.

One of the strongest arguments in favor of baby beef—by which I mean early maturing steers—is that you can dispose of twice as many that ripen at two years as you can if they have to be kept for four before they are ready for the market. In this early development we claim for the Herefords a superiority over all other breeds, given the ordinary care and treatment that the average Michigan farmer gives his cattle, while under the forcing and pampering processes they are equally victorious. This advantage becomes of great importance when we remember what all feeders know, that the meat that is made the first two years costs less than that put on the last two. In conclusion, I may say here what I said two years ago before the Brick and Tile Association that met in this city.

"If farmers of Michigan expect to compete successfully with those of States, east and west of them, they must commence at once to under-drain their farms, so as to insure good crops every year, whether the season is wet or dry. They must stock their farms with the best breeds of cattle and sheep of meat producing qualities. They ought to be able, and must strive to supply their own home markets, of Detroit, Grand Rapids, the Saginaws, Bay City, and other rapidly growing manufacturing cities in our State. There is always a home demand for the best the markets can furnish, and at remunerative prices.

The days of large cattle ranches of the West are rapidly drawing to a close. Settlers are passing into those States and locating on lands that have hitherto been used for pasturage. The public domain will soon be settled with farmers. The wild bunch grass of the prairies is disappearing rapidly under continued grazing; vast areas that a few years ago furnished pasture for thousands of cattle are now worthless for that purpose. It will only be a few years until the vast wheat belt of the west and northwest, that is now producing twenty-five to thirty bushels to the acre, will, like Minnesota and Iowa, average less than ten. Constant raising of one kind of crops impoverishes the land, except it be meadow or pasture, which is annually top-dressed.

Under-drainage, rotation of crops, feeding of stock, with an intelligent selection of breeds for the purpose you have in view, will insure the present and future farmers of Michigan security against any competition in America.

Mr. Freeman: I have farmed 30 years and never raised a scrub nor sold beef for less than five cents on foot. Today I was offered a hind quarter of dressed beef for four and one-half cents. What do you raise such beef for? I can raise five cent live weight beef for less per pound than you raise two

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and one-half cent beef. They need the same pastures. The county average, for ten years past, hasn't exceeded $30 for three-year-old steers, at two acres per steer per year. Now take three acres and pasture two and raise corn on one and you can make a steer in three years that will bring $100. The $30 steer costs $34. The $100 steer costs about $50. A ten per cent loss on the first; a 100 per cent profit on the other. First get the right breed and then feed it. For calves I would give corn and oats mixed with bran and not ground; a little at two weeks old and soon after as much as it will take. I advise cutting corn fodder rather than feeding stalks.

I can hire all the labor on a farm and make eight per cent profit by merely seeing to it, without doing any work myself. My farm is worth $50 an acre, and over and above labor and wear and tear of machinery and all expenses, I can make eight per cent on 465 acres, of which 130 acres is timber.

I doubt if one farmer in twenty, in this region, takes an agricultural paper.

Dr. Miles: A few years ago, at Smithfield, the big animals took all the prizes. Now quality is influencing this. As to points in judging, put a a line from the point of the shoulder to the stifle or knee joint, and see how large a proportion of the animal is above this line, as the high priced meat is above, and the waste parts below it. See how well it is filled out just back of the fore leg and before the hind leg. A long thigh bone and a long shoulder blade are good.

Mr. Rosencranz: As to feeding ground corn and oats to calves, I tried it on a three-weeks-old calf and it killed him, and his stomach was full of oat hulls.

Mr. Stuart: I like open sheds for cattle in winter. Stabling and tying is needless unless on account of goring by vicious animals.

Dr. Willson: We have not had trouble with our calves in open sheds, 30 and 50 together. We have no trouble feeding oats two parts and corn one part.

Gov. Luce buys cattle to feed, and never has sold for less than six cents per pound, and feeds as we do.

We ripen our steers in June on pastures and grain, and get, at that time, the top of the market, sometimes eight cents per pound.

Mr. Goodyear: Have you been able to improve your animals on the first purchases, Velvet Jacket and Harry?

Dr. Willson: I don't know that I can say that, as those were very fine animals, but I think Gallant is, perhaps, an improvement in being very low bodied.

We began with 60 heifers and gave 20 of each to Shorthorn, Devon and Hereford bulls, and kept it up for ten years, and then abandoned all but the Herefords for profit.

Mr. J. W. Foster, representing the Crapo farm in Gaines, which has heretofore been devoted to breeding pure blood Herefords for breeding purposes only, read a short paper detailing his experience in breeding thoroughbred steers for beef only. He said that his method was to take the calves away from the cows while very young and bring them up on the pail, feeding new milk for the first few weeks, and then feeding milk from which cream had been taken by the Wilson creamery process. At the age of three months commenced feeding grain, which was kept up during the season. In this way steers mature for market early and can be produced at

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a profit, even on high priced lands of Michigan, from high priced animals, and in the present depressed state of the beef trade. He did not believe in specialties but in mixed farming. In this way he thought the problem of getting money out of farming could be solved.

He was opposed to trying to breed a general purpose cow. He would breed some line of animals for beef and another line for milk, but would not try to get both qualities in one breed of animals.

Dr. M. Miles: As to mixed husbandry, the argument is not mainly to avoid having all your eggs in one basket, but to keep the residues on the farm.

Stolen crops that grow vigorously late in the fall and early in the spring like rye, save elements of plant growth that would otherwise be washed out and lost.

DEVONS THE BEST BREED OF CATTLE FOR MECOSTA COUNTY.

By John R. Snyder, Big Rapids February 8, 1889.

To combine all the good qualities of all separate breeds of cattle is impossible, but as the breed that combines the most of the good qualities of all we think the Devons will carry the palm. While the Jerseys would equal them as butter producers, in other particulars they would come far short. The Holstein for cheese, the Durhams for beef and other breeds might excel them in other particular lines; but the many good qualities of the Devon cattle combine to make them the best suited to this locality of variable climate for general use. Their extreme hardiness, docility, the quantity and quality of their milk and butter, a quality of beef exceeding that of any other breed and their superiority as work oxen are acknowledged by all. Professor Youatt gives the highest rank to the Devons as work oxen, and our own experience bears out his opinion. While some may contend that the Durham or Holstein would be the most profitable on account of their being so much larger and so making more beef, I would answer that we cannot compete with the South and West in raising beef, as it costs us too much to mature cattle here. A review of the Chicago markets shows that while we sold our beef dressed for four cents per pound, those western stock raisers realized live weight five to six cents per pound, and too, they can place four to five in market where we do one, and at about the same cost of production. Hon. John Wentworth of Chicago kept Durhams, Devons and Jerseys; of the Devons he says, "They are the hardiest cattle in the world and the greatest favorites in cold climates * * * * * the cows continue their milk all winter out-doors, their thick coat of hair is impervious to storms, they are in every sense of the word the poor man's cattle."

Mr. Williams: I bought three years ago two registered Devon calves for $50 and can make more butter and beef per ton of feed than you can make from any other breed.

Mr. Escott: I like the Durhams better, since the end of all cattle is beef, and when you come to beef the Devons are too small.

Mr. Williams: Most people prefer Durhams because they have never had anything else. Give them a Devon and it will convert them.

Mr. Escott: I have seen them, and they are very pretty and fat and nice, but they are too small.

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BUTTER MAKING ON THE FARM.

A. B. JOHNSON.

Read at the Farmers' Institute at Lake Odessa, February 12, 1889.

HOW IT IS OFTEN DONE.

Careless milkers often place their pails so that other substances than milk fall into them. The milk is then strained through a single coarse strainer into shallow open pans or crocks and set on a self, where, if in a cellar, cobwebs and dust, broken loose by persons passing above, by a draught of air may fall into it, or in the midst of fumes arising from onions, decaying pumpkins, potatoes, squashes, turnips, apples, etc. Or, if in a pantry, which is probably poorly ventilated, if at all, absorbing the combined odors of pies, cakes, meat, coffee, cinnamon, and a score of other articles. Then, if the cream arising from the milk is intended for butter, the milk is allowed to stand until it is not only soured but curdled, and decomposition is begun. Then the cream is taken off and kept in a jar or can until enough has accumulated for a churning; and by that time quite likely the first cream put into the jar is so decomposed as to be entirely unfit for use. It is then churned.

Usually taken from the churn into a bowl, where some people prefer to *work* out the milk rather than wash it out, and perhaps some of the milk left in the butter. The next process being the salting, the salt is put on *by guess*, and worked in by a *drawing* motion, the whole mass worked, and *worked*, and *worked*, until the butter is as grainless as grafting wax.

Is it any wonder that there is so little really good butter in a market which is supplied by the product of the surrounding farms, when any one of the unfavorable conditions mentioned will injure the article, and when several of the said unfavorable conditions are usually present, and sometimes all of them?

HOW IT SHOULD BE DONE.

First, the milk should be drawn from a healthy, well-fed animal by a careful person. The pail should be held well away from under the udder, so as to keep the milk as clean as possible, since filth of any kind is fatal to good butter. The milk should be *thoroughly strained* and set in perfectly clean vessels, as a piece of curdled milk the size of a pin-head will, under proper conditions, spoil the entire contents of the vessel.

The cream should be taken off as soon as the milk begins to sour.

The temperature of the milk should not be allowed to go below 60° nor above 70° after the animal heat is out.

The cream should be churned within thirty-six hours after skimming.

The milk should all be *washed* from the butter.

One ounce of pure salt should be added and *pressed* into the butter.

The butter should then stand for from ten to twenty-four hours, when it should be worked a little and molded for use.

Mr. Stinchcomb: If the cows are not healthy let the pigs make the butter.

Mrs. English: Is it necessary to let butter stand before working the second time?

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Mr. Johnson: The first working is to mix the salt; then as that dissolves it makes streaks of salt that needs to be worked out, and there is no use in trying to complete the job at the first working, as it can't be done till the salt is dissolved.

Mrs. Fellows: If we have but one cow how can we churn within 36 hours of milking?

Mr. ——: Keep a Jersey!

Mr. Fellows: Cleanliness and the kind of feed are prime elements of good butter. My wife never lets me go near the milk pail after milking till I have washed my hands.

Mrs. Jordan: Will washed butter keep when packed as long as unwashed?

Mr. Johnson: Milk or buttermilk decomposes butter as quickly as any other cause, and I know of no way of getting this out as well as by washing.

Mrs. Jordan: Is soft water better than hard?

Mr. Johnson: Very hard water is not as good as soft; but the soft water must be clean.

Mr. Hutchins: What breed is best for butter, and what feed? My experience has been with Holsteins, fed with corn fodder and one-third corn and two-thirds oats, ground together.

Mr. Carter: I have tried two Holsteins, and have not had good results as compared with others.

Mr. Dillenbeck: I keep Durhams, and feed like Mr. Hutchins. Good feed and stabling, and cleanliness in making are the chief elements of good butter.

Mr. E. W. English: We have Red Polled cattle, and feed as Mr. Hutchins does, with the addition of wheat bran and roots—flat turnips, potatoes or wurzels, and like our breed for butter and beef. Think the bran adds much to butter yield. I feed one bushel of bran to one bushel of ground feed—one-third corn and two-thirds oats.

Mr. Cooley: My cattle are grades, Durham, Devon and Hereford, and I think feed will make them all good.

Mr. Friend: I combine stalks and clover hay, and equal weights of corn and bran. I like that better than only stalks. I have made butter 30 years and for some years found selling more of a trick than making. It takes some gumption to make butter. Three-fourths of an ounce of salt to one pound of butter is enough, if you wish the best price. Years ago my wife did it all, and salted by guess. Later I took it in hand, and weighed one ounce to the pound, but the customers complained of the amount of salt and I found that three-fourths of an ounce is enough.

Mr. English: I think deep setting better than shallow, as you can better control temperature and it saves labor. The ladies find this a great consideration.

Mrs. Wachs: I fully agree with this. We set three-gallon cans, so deep that the cream is three inches thick on the top and it saves greatly in labor.

Mr. English: Our Red Polled cattle are all young; the oldest five years old. A three-years-old, in milk three weeks, makes one pound of butter a day. There have been cases of the breed making fourteen pounds a week for nine months.

Mr. Wachs: I advocate deep cans, outdoors in water or snow. Last spring we had two two-years-old heifers and a poor cow coming in in summer. I had cans twenty inches deep with flat lids, seven and one-half inches in diame-

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ter at the bottom and nine and one-half at the top, holding four gallons. I milk at 6 A. M. and 6 P. M. regularly, and feed at the same time of day always. For three years have fed mangels, and can notice a loss of milk in two feeds without them. My cows shrink on raw potatoes and go dry on sour apples. Deep setting and quick cooling is best. I milk, myself, into a strainer pail and stanchion my cows on a platform, keeping them clean and let no straw or rubbish get in my milk.

Mr. Spaulding: Has anyone fed ensilage for milk? A neighbor of mine uses it and tells remarkable stories of its success. He sells milk to the Lansing condensing factory and they praise the milk very highly.

Prof. Johnson: We have fed ensilage since 1881, and corn or clover ensilage is unquestionably the cheapest and best food for stock in winter. Hiram Smith of Sheboygan, Wis., feeds it very extensively with bran for butter making, and says he can teach a bright young man in two weeks how to make first class butter.

Mr. Friend: How about oil meal? My experience has been disappointing.

Mr. McKee: On the Harrison farm, near the College, we had a good many cream customers and other milk customers, and we fed as near clear corn meal as we could to produce cream, and we had no success with oil meal. The same was true on a dairy farm near Buffalo where I was when a boy.

Mr. Johnson: Will Mr. English say how the Red Polled compare with Durham for milk and butter?

Mr. English: As good as some and better than others.

Mr. McKee: On the Harrison dairy farm if we wanted quantity of milk we bought natives and if we wanted cream we bought Durhams.

Mr. A. B. Johnson: It used to be the practice to skim after milk thickens at the bottom. On a dairy north of San Francisco, of 160 cows, we did this and used shallow pans until some Swedes taught us deep setting and sweet skimming, so as to make cheese of the sweet milk left. Our butter had been as good as theirs, but they made more from the skim milk than we did by feeding our sour skim milk to the hogs. Our cows were Durham grades.

We made for the San Francisco market and found one and one-fourth ounces of salt per pound necessary to insure the butter keeping six months. Why does heating cream facilitate butter making? Because it is usually kept too cold. The milk room should be 60° to 70° the year around for best results. In Michigan, people do not salt the cattle enough. I salt daily, morning or evening, or both, a handful for one-half or a dozen cows, and you will never need to chase after your cows, they will come themselves.

SWINE ON THE FARM.

BY J. W. HIBBARD.

Read at the Flint Institute January 31, 1889.

If there be any fact in feeding that is thoroughly settled, it is that no animal intended for food is being properly managed that is not gaining in weight. It is estimated that the amount of corn required to winter a 100 pound pig is ten bushels, or about three pounds per day. If only this

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amount is given there will be no increase in weight, as all the feed is required to sustain life. For those who have not the confidence to feed their stock liberally, it would be much more profitable not to keep any; for, to empty our crib of corn and not have a pound of pork to show for it is the height of folly.

Let it be remembered that the quicker any animal, intended for meat, will demand the highest price, and produce the best meat, the more profit there is to the feeder, or in other words, every day they do not gain in value to us we must charge them with their board.

And again, it is a certain fact that the improvement of our stock is of no use in any other way except to more profitably convert their feed to our profit. Hence the improved, or well bred animal is simply an improved machine to convert our feed into money, and except it is given a chance it cannot perform this service for us.

I have never been able to get breeding stock too fat if plenty of exercise was given and proper kinds of feed. There is one rule that applies well in most all places in the improving of our stock, and that is that like produces like. And this rule is especially adapted to this part, for if we would improve the feeding qualities of our swine, the place to begin is with our breeding animals, and so feed them that they do not know what hunger is, and they will produce young that have no knowledge of hunger, and if the dam is in high flesh she is capable of feeding her young so that they are in good flesh while dependent on her for their support. And if we do our part when they are dependent on us, and so care for and feed them that the so-called baby flesh is never lost, and so continue from one generation to the next, it cannot help but produce stock that will be easy keepers.

I think it is impossible to produce a healthy and palatable meat on any animal that is confined in a small pen all of its days, and a great part of the time in filth, and fed upon all kinds of unhealthy foods.

But they say this is the most profitable way to feed them; but if we persist in feeding and keeping them in this way, and so ruin the demand for the product, the loss is our own.

I think a hog should always have a good large yard to exercise in at all times during his life, so that he can have the ground when he wants to exercise his muscles, and should always have a dry place to sleep, not too warm but with the cold wind and storm broken off of them. And as a rule they should be forced to come somewhere for their feed, and, where it is possible in summer, a clover field is the place for them.

The practice of ringing hogs is not only cruel but is detrimental to their well doing. The reason for ringing given by most of those who practice it, is that they root so much, but I have found that when a hog had plenty to eat given him he had but little disposition to root.

Whole corn is the principal food for hogs, especially in fattening them. It is my opinion that it is not the proper feed alone for swine at any time during their life, but should only be fed in connection with other feeds, such as wheat middlings, barley or oats, roots, and skimmed milk.

As the mixed feed not only produces a healthy hog but generally improves the quality of the meat, by producing a much harder, finer grained and much more lean meat to fat. With me, wheat middlings is of more value in feeding hogs than corn, and there is no time during their life that wheat is not a part of their food.

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Experience has convinced me that during winter it is profitable to give warm feed at least twice each day, and besides this, by the use of a cooker, we can utilize many things about the farm with our swine at a profit to us, much better than any other way.

COUNTRY SCHOOLS.

BY PROF. H. R. PATTENGILL.

Report of Talk at the Lake Odessa Institute.

MR. CHAIRMAN, LADIES AND GENTLEMEN: The school is an appropriate topic in any American audience. In our history it has stood side by side with the church in the advance of our civilization from the foundations of our pilgrim fathers to the founders of each of our western States. They developed not only our public schools, but public academies, the university, the agricultural college and the normal school, and today these higher schools are not excelled anywhere in the nation.

We pay much for these things, and I want to seek out the several essential factors of a successful school. Each of these factors must be pregnant to save the product from being zero. The three factors of a good school are pupils, teachers and patrons. Pupils to be good efficient factors should come to work with some ambition in them and understanding something of the possibilities before them, what success in life means. Is it necessarily political preferment or wealth?

No, young man. He who establishes himself in a good and useful activity where he can do all the good that he can, to all the people he can, in all the ways he can, and as long as he can, and does it, is a success. Trashy literature affects injuriously mind, memory and morals. Guard against it; not by scolding or forbidding it, but by furnishing something better. That is success.

Much of the benefit of a good school depends upon the patrons. You pay your taxes well enough; in fact you pay more for schools than for anything else, and watch it less. You say that is the teacher's business. Is that the way you have your hired man take care of your sheep or your colts?

Don't visit the school just to find fault. Don't find any fault with the teacher before the pupils or let them know of your criticisms. Above all don't let little neighborhood quarrels break up a good school. I don't know whether this coat fits here or not, but if it does please put it on and wear it. Don't let your disagreements come near the school.

Again, you should be a judge of a good schoolhouse. Not that I want you to tear down your schoolhouses, but you can often remedy defects of ventilation; e. g., put a zinc jacket around your stove to within four inches of the floor and let in cold air from the outside by a pipe running from the outside beneath the floor and opening under the stove. If you build a new one don't build just as Noah did for Shem, Ham and Japeth. Don't be as the cap makers, who refused to make ear tabs where the ears were because they had not been made to fit before.

Don't be too much afraid that the children will study themselves to death. Some of them do die, but it isn't often the fault of too much study. It is cigarettes, dancing, roller-skating and such things—bad dresses, bad food,

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bad hours. Give them habits of industry, give them something to do, and don't let them have all play and no work, for it will make rascals of them.

Then ventilate your schools. Give windows chiefly on one side and well up toward the ceiling, equal to one-fifth the ceiling, and bunch them toward the back part of the room, and have the blackboards forward where the light will shine on them instead of in the children's eyes, and have the blackboards low enough for the scholars to reach. For apparatus, get a moderate globe, a few good maps, a good dictionary, and, above all, a moderate stock of good books—a school library for reference.

Now once more, don't side with your children against the teacher, but have it out with the teacher by herself. Don't disparage her to or before the pupil. Stand by the teacher.

Much of your money is wasted by frequent changes of teachers. You have a time of it to run two or three children at home, and just think of a teacher getting running with twenty to fifty, and making them little angels in one term.

Now, teachers, you may have the best of pupils and patrons, and if you are a mere school keeper the product will be zero. No matter what your salary. If you have contracted to teach for $10 you must not undertake to teach a ten-dollar school, but to teach the very best school you are capable of. And what is that? To teach the scholars to think. And what is the most practical study to that end? Reading! Arithmetic, algebra, grammar will make them think, but reading is the fountain of thought. Teach them to be *devourers* of good books. Now do you doubt the value of grammar? It is not the facts or the rules or the "learning how to talk good," but it is the analysis, the thinking, the training of the mental powers in which consists the highest value of grammar, or, indeed, of any study. If you have got this idea you won't teach geography by long lists of meaningless names and figures, but you will teach the reasons for and the meanings of things.

Lincoln, when keeping grocery in southern Illinois, dug out his grammar by himself. What for? He wanted to master it; and so when he came to write his inaugural and Gettysburg speech, when he came to face problems of state, he was prepared to master them.

Don't teach numbers to the littlest ones; give reading first, and teach that by words first and not by letters, and don't let them say "I! see! ă! dog!" but "I see a dog!" Don't point at the words when he is to read a sentence, unless it is words you want, and then skip forward and back. In teaching fractions take a two-foot pocket rule to illustrate with and skip from boy to boy. How to keep order—know enough to interest, and then have "a hand of steel in a velvet glove"—use kind firmness.

THE TOWNSHIP DISTRICT SYSTEM.

I am converted to it from being an opponent. We now employ twice as many teachers as we need because we change so often. Local quarrels and nepotism flourish under our present system, while by putting all the districts of the town under one township board they would be avoided. Fourteen states have tried and like it. New Hampshire has found it far more economical. Our State has 87,000 children who have less than the average schooling. I know of a district where there was but one pupil, and of many

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where there were less than ten scholars per district, and the average cost is $55 per head, while for the State at large it is but $7.

It has been tried in Alpena county in five out of seven townships by special legislative act. Those five townships had twice the school at one-half the cost of the old system. I see no reason why we should not have a local option law permitting townships, when they desire, to adopt this system.

Pres. Willits: How is township system organized? Say here is a district with ten pupils who have to walk a mile, will you unite it to others and make them walk two or four miles?

Prof. Pattengill: Make the whole town one district so the pupils can go to the nearest school. Yes, in certain cases schools will be discontinued, and if necessary children would be carried to school at public expense, and that will cost less than keeping a separate school for them. Also a central high school will probably be organized in the township.

OUR COUNTRY SCHOOLS.

BY MRS. HETTIE WARNER BRADLEY.

Read at the Albion Institute, February 20, 1889.

Every loyal heart is filled with patriotic pride and enthusiasm when thinking of our country. A vision immediately presents itself of her vastness and productiveness; of her talented and cultured inhabitants; of her progress and prosperity; of her churches and colleges; and of her remarkable common schools.

Our country's schools are among the grandest institutions of the grandest nation on the face of the earth. The framers of the constitution, under which we live and thrive, realized fully that general intelligence and enlightenment is the only safe support of their government plan. How to rear a nation of thinkers has been a question ever prominent before the public mind. And this is the universal answer: Through the medium of the schools.

Agriculturists, as a class, depend upon the district schools for the education of their children. There are many exceptions. We find hundreds of farmers' boys and girls acquitting themselves finely in the colleges and universities, but even there their advancement will depend upon the thoroughness of early teaching. Some of the wisest and best men and women, who figure in the history of this republic, and others who are doing grand work at the present day, received the elements of their education in country schools. Then may our boys and girls feel encouraged, remembering that in some respects they have the advantage. As all grades recite in one room those especially gifted have opportunity to cultivate that particular talent. Younger children hear the recitations of more advanced classes, and become familiar with knowledge above their grades; while the older pupils have no opportunity to forget the fundamental principles underlying all school training, as they hear them daily repeated. Then the invigorating walks along the public highways where they may learn so much of vegetable and animal life, and other ennobling influences, which seem to bring them in closer fellowship with the Great Ruler and Creator, and cannot fail to lead their thoughts "through nature up to nature's God."

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Under the present law we have in each county the secretary of the board of school examiners, who acts as superintendent of the various schools. We can imagine him passing through our fine farming country, noting the beautiful farm houses, the fine horses and carriages, the cultivated farms supplied with all labor saving machinery available, and then note his astonishment upon entering the schools supported and controlled by the men who own the farms. Many of these school rooms have very imperfect, if any, ventilation, are devoid of dictionaries, globes, charts and maps. The superintendent of public instruction reports in 1887 that of 6,543 country schools in our State but 3,519 have dictionaries, 1,773 have globes and 2,228 have maps. Many have little to enliven or beautify within, and no attempt at improvement or adornment without. Placed as teacher of a dozen or score of children of all ages, the examiner finds a young, inexperienced girl, possibly a graduate from some high school, who wishes to earn a little money, and review her studies, nevertheless sadly incompetent to train the susceptible minds of children. She is often allowed by the school board to follow the inclinations of her own sweet will while she reigns therein, the result being generally poor scholarship and time irretrievably lost. Would it be at all surprising if the superintendent should sharply criticise the patrons, even if he thought them ignorant, penurious, or what is worse, utterly indifferent?

We admit that all must begin their work as teachers somewhere, and that one class of children may suffer as well as another. But we may reasonably expect that candidates for teachers have some love for the work and interest in it, and that they make some efforts to keep up with the times. We may expect them to have a degree of judgment and discretion, and a loyalty to truth and right, for a teacher's influence cannot be measured. They have the children under their control six hours a day, five days in a week, and from seven to nine months in a year.

The impure air of the school rooms which enters the lungs cannot do the incalculable injury to pupils that is done by impure morals of teachers. One may shorten life, the other may result in moral ruin. A few weeks ago we heard a prominent man of our State advising young teachers to make their first efforts in country schools, as less was required of them by the board and they could be learning for themselves, but, on the other hand, he would not advise school boards to employ them unless they would take personal supervision of the school.

One great source of failure in country schools is in attempting to do primary, intermediate and high school work in one day, by one teacher. It is a self-evident fact that this cannot be well done and that a multitude of classes must necessarily be detrimental to the progress of the scholars. This matter can be regulated and controlled by those in authority. Limit the work of the district school to the most essential branches. Would have pupils learn reading, writing, orthography and rhetoric; have them become familiar with the history and civil government of their own State and Nation; become acquainted with the English language, its uses and formation; have them taught arithmetic systematically and thoroughly; and as our State wisely decrees, the elements of physiology and hygiene. Thus we may lay a broad and firm foundation on which a useful life may be built. Should it be in the kitchen, on the farm, in the workshop, the school room, the counting room, the pulpit, the legislative hall, or in the White House. If any thirst

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for greater knowledge let them seek admittance at the doors of the higher institutions of learning the State so liberally supports.

Every district would have a circulating library if all the money belonging to that fund was legitimately used. A teacher suggests that dictionaries, encyclopedias and other books of reference be purchased with this money if there is no library. It certainly would be as lawful as using it for other purposes.

All interested persons, especially mothers, should attend the annual school meeting, where plans for the ensuing year are devised. Let them place upon their school boards men and women who will conscientiously assume their duties, with a determination to work for the public good; who will study the books of Michigan school law, and abide by its instructions. In short, let us choose the wisest, most prudent and public-spirited ones in the community. If they cannot afford to spend the time required for the work, pay them a salary and expect them to earn it.

The county officers are making persistent efforts to raise the standard of country schools, but these efforts will avail little if they do not have the hearty co-operation of patrons. It would be a good plan for patrons, officers in particular, to attend meetings of teachers' associations, and get an idea of the work that is being done by others, hear the discussions and profit by them.

Children need social, physical and moral, as well as mental training; one cannot be neglected without affecting the others. God has created us social beings, and children on the farms learn this as quickly as others. It then is one of the duties of farmers to give their children good social privileges if possible. In this vicinity we have found it pleasant and profitable to organize literary societies in the different localities, there being nine within as many miles of this city. Several of these societies admit men, women and children, who seem equally interested. Even at social gatherings, literary programs are rapidly taking the place of progressive euchre and the dance. Some of these societies have a school committee appointed each month in each district, consisting of three persons, whose duty it is to visit the schools in their various localities and acquaint themselves with their condition and progress, and encourage the teacher in her work. This interest is appreciated and may accomplish great good.

After all the money, study and legislation expended, we may find ourselves in the dilemma of the physician who worked hard, faithfully and successfully to set a broken bone. It was in the back of a man's neck. His final conclusion was that setting the bone was an easy matter, the difficulty was in making the man live. If school training fails to impress upon the minds of the young that they must live, and that they are only true American citizens who are capable of earning their own livelihood, then there is a grievous mistake somewhere which can only result in disaster and ruin. Many of our young graduates seem to expect that the world has made a place for them, and feel sadly disappointed that they must work their own way to success.

Fortunately the pupils in country schools have no lack of manual training. The scarcity and consequent expensiveness of help, making it necessary for farmers' children to learn to work as early in life as possible, and they have fresh air and sunshine in abundance. Within the school room there is such a lack of practical training that young people must acquire the

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knowledge necessary to fit them for actual life after their education is supposed to be complete. There is nothing degrading in physical labor, else the most of us would be groveling in the dust. We must teach the young that bread must be earned if we do not wish to become a nation of tramps, paupers and criminals.

Some prominent teachers say that they judge a child's scholarship by his ability to read, write, compose and spell a few sentences of the English language correctly. Our farmers say the scholars should be able to tell the amount of a load of wheat when sold; find the area of fields knowing the dimensions; give accurate descriptions of their own and neighboring farms; measure the wood and lumber; calculate the number of bushels in bins of wheat; in short, understand questions of practical utility. In this direction you can aid the teacher by giving practical lessons yourself to the children. They must learn the relation of cause and effect, must have judgment and forethought and general ability in order to become successful in life.

Mr. Pattengill, of the School Moderator, at a recent meeting in Marshall, made a statement to this effect: Hundreds of farmers' boys had come under his instruction. He had often found them inferior readers, incorrect spellers, not always able to express themselves grammatically, but he always found that they could think and reason. This statement is a gratifying compliment. If they have the power of thought these other things may be added unto them. After reviewing the situation carefully a gentleman says: "Educate the masses, but make that a practical education, which will fit people for the duties of life."

What is knowledge without health? The mind cannot reach any degree of successful development within a body composed of diseased nerves, compressed lungs and bad blood. Everything in our school rooms and school government, in our children's clothing and food, should be adjusted with especial reference to a healthful development of the physical organization.

Members of the W. C. T. U. and other moral and religious people have long realized the danger to the youth of our land from the use of tobacco and alcoholics. Time will not allow the giving of statistics concerning the yearly demand for cigarettes, liquors, etc., but the quantity is appalling. A desire to forewarn children of their danger, and a belief that the cultivated traits of this generation may become the inherited traits of another, has led to the enactment of our Scientific Temperance Instruction Law, a portion of which reads as follows: "Instruction shall be given in physiology and hygiene, with a special reference to the nature of alcohol and narcotics, and their effects upon the human system. * * * The district board shall require each teacher in the public schools of such district, before placing the school register in the hands of the director, to certify therein, whether or not this has been done." Farmers have temptations peculiar to themselves. Little boys often learn to use tobacco of older pupils, and sometimes from teachers. Hard cider is placed in cellars, where boys can early learn lessons in drinking. Mothers are sometimes melancholy witnesses of the daily degeneration of innocent, promising boys into incipient drunkards within their own homes. Thus the duty of teachers in country schools is apparent and imperative. It is a surprise to teachers to find how readily pupils will learn and comprehend this study when it is properly explained. The wonderful network of lines called nerves

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which traverse the whole system, the miraculous organ which at every throb sends the life-giving blood into the most minute parts of the body, the great busy brain at work within the cranium, the intricate machinery of the digestive apparatus, the manner in which air penetrates the cells of the lungs, and then the deadly effects of alcohol and tobacco on all of these living tissues, are as well understood by children from five to ten years of age, as by men and women of middle life. Our age cannot be credited with the original idea of teaching temperance to the young. We find in the Bible that the children of the Rechabites to the third and fourth generation were taught total abstinence. And when the immense family were strongly urged to drink wine, they defended themselves by saying: "We have obeyed the voice of our fathers, who charged us to drink no wine in all our days, we, our wives, our sons or daughters." If our law can be universally enforced and the children everywhere taught the dangers of these poisons, we may look for grand manhood and womanhood among the youths of our land. Will we allow these valuable laws which have been enacted at great expense to tax-payers and through the agency of prayers and thoughts and labor of the best minds of our State—aye, can we afford to allow them to become "dead letters" on our statute books through lack of energy and interest? Our superintendent of public instruction says: "It is certain that no measure can be made more effectual for the advancement of the cause of temperance and morality than thorough and faithful and honest instruction given in our public schools to all pupils in regard to the effects of alcohol and narcotics on the body and soul."

Our public school system is dear to the hearts of all American citizens, and may we guard it jealously against all encroachments. Mere intellectual training does not insure good citizenship, as the records of our reformatory institutions will furnish abundant proof; therefore, if we wish to have a nation of thinkers—upright, honest, industrious, temperate—we must have these principles thoroughly incorporated into our system of public instruction, for "Whatever you would have appear in a nation's life you must put into its schools."

DISCUSSION ON TOWNSHIP UNIT FOR SCHOOL DISTRICTS.

Mr. Powell: Farmers who appreciate the value of education often feel, as their children approach maturity, that they must move into town in order to secure the better schooling there offered. This ought not so to be. Country children are entitled to their country homes, and to receive within reach of them as good schooling as is afforded to city children. This can only be done by organizing the townships as single districts, and establishing at or near the center of each a township high school. This would be more economical than sending our children away from home and its saving influences to shift for themselves in the cities, and more economical than for us perforce to move our homes and ourselves to the cities for the purpose of reaching the schools.

Mr. Gorsline: This township unit system insures to all of the children in a township equal educational opportunities, be their own especial neighborhood poorer or richer than the rest of the township.

It also lessens the burden of taxation both by distributing more equally the cost of maintaining the schools and by materially lessening the cost.

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Mr. E. Davenport: In 1881 I corresponded with the school authorities of 21 States on the main features of their school systems, and none of them found any fault with the township system, and many spoke cordially in favor of it. This is no new thing, no mere theory. The first schools in America were established in Massachusetts on the township system.

It would save at once all the trouble and confusion resulting from fractional districts; it would establish in large measure a uniformity of text books; it would give better teachers at less aggregate cost; it would greatly lessen the number of school officers, and, finally, by establishing a central high school in each township it would enable us to educate our country children at home, so that they may grow up loyal to the land of their birth.

Prest. Willits: If it were proposed to make the adoption of the township district system compulsory upon the counties, I should recommend that we go very slow in reaching a decision; but the best thing about the proposed law is that its application is left optional with each county. The truth is, after all, that our old district schools are pretty good institutions.

The opinions favorable to the township system, quoted by Prof. Davenport, are all from interested parties, that is, from State superintendents and others who would gain in power and influence by this centralizing process.

The question arises, why, if centralizing the management of the township schools is good, it should not be still better to continue the process farther and make the county, or several counties, or the State the unit? Where shall we stop? What in the nature of things determines the township instead of the district or the county to be the best unit?

In my experience of six years, at the head first of the State Normal School and then of the State Agricultural College, I have found that on the average we received quite as good material from the country district schools as from the village high schools.

Prof. L. R. Fisk: The teachers of the State are nearly unanimous in favor of the township system. One of the strongest gains as seen by them is that by it a better grading would be made possible. On a recent visit to my old country home in New York State I was much impressed by the relative inferiority of the educational advantages afforded to the country children as compared with those enjoyed in the cities. No one would think of organizing city districts independently of one another, or of saying that the poorer nighborhoods should only have such facilities as their own taxation would support. Why then should we act on such principles in the country? Why is it wise to have from six to twelve times as many school officers in every township as there is any necessity for? Though it is undeniable that many of our best students come from the country, yet it is in spite of and not because of this poorer schooling. Their other conditions may be favorable enough to more than balance the deficiency on the whole, and yet the same bright country students do find themselves hampered by the lack of the training and culture which the city children receive. Let us have that system which allows the utmost degree of coöperation and economy.

Mr. ——: In the township of Bedford there are 12 school districts and 10 different readers, 11 different arthmetics, 8 different grammars and 36 different officers. The proposed system would do away once for all with such confusion and waste of money. It would give us a better and more responsible management.

Mr. ——: I have noticed in farmers' clubs a tendency to disparage country

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schools which I think is generally unjust. I have a 19 year old daughter who graduated through the regular course here in town a year or two later than companions of her own age who had staid longer than she did in the country district school. It seems to me that with all their shortcomings and disadvantages, those ungraded or crudely graded schools develop a general common sense thinking power that is often missed in the more artificially elaborate systems of the city schools.

FREE TEXT-BOOKS.

BY S. GORSLINE.

Read at the Albion Institute, Feb. 20, 1889.

"The district board shall prescribe the text-books to be used which shall be uniform in each subject taught."

When this law was enacted by our legislature, it was hailed by our educators as promising a remedy for a great and increasing difficulty in their successful work. That it has been almost a total failure, is known to every one connected with our public schools.

We find in the same township, and sometimes in a single district, so great a variety of text-books used that no book-seller would undertake to keep a supply. In this county we have in use ten different authors in reading; spellers, six; arithmetics, ten; grammars, seven; histories, eight; physiologies, ten; civil governments, five, and book-keeping, four.

I need not stop here to enumerate the evils caused by this state of things; the loss of valuable time to both teacher and pupil, the added expense to the patron, the unsatisfactory work that at the best can be accomplished under such circumstances are already well known. How may they be removed?

By making text-books free, or furnishing them at cost. Supt. John Jasper, of New York city, says: "The board of education furnishes all pupils in the public schools with books and school supplies free of expense, and this meets the hearty approval of the citizens of New York city."

State Supt. E. A. Apgar, of New Jersey, says: "Nearly all our cities furnish text-books free of cost to the children. We have 1,500 school districts in the State outside the cities. About 400 of these supply free text-books. It is my endeavor to get all the districts in the State to adopt the policy which now prevails in so many."

At the California State Teachers' Association, C. B. Towle of Vallejo, was appointed a committee to obtain information on the subject. He received replies from thirty-five States concerning uniformity laws, free text-books and text-books at cost.

"The more the subject is studied, the more positive one becomes that, all things being considered, the end of the text-book question will not be reached until everywhere books are supplied free of cost to the pupils, obtained by the city, town or district direct from the publishers."

A gentleman connected with the schools in the Province of Ontario said the board of education there prescribed and furnished at cost to all pupils text-books used. They purchased the copyrights of all works adopted, and then published them at government expense, and were furnished to pupils at cost. When shown a book that retails here to our pupils at $1.40, he

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said it could be furnished there at about 45 cents. Why not use our presses at Lansing, etc. There is scarcely an institute or teachers' association held in this county without there being present one or more representatives from different publishing firms, and these are paid from $1,200 to $1,800 salary per year and all expenses paid, *and we pay these bills.*

SOME OF THE ADVANTAGES OF FREE TEXT-BOOKS.

1. Economy. The superintendent of the Lacrosse, Wisconsin, schools says: "It does not cost this community one-third of the former cost of books." Books will also be used until worn out. Our shelves are loaded with school books little the worse for use, but now entirely out of date.

Superintendent Henry B. Pierce of New Bruinswick, New Jersey, says: "For the past eighteen years, our school readers have not cost on an average more than ten cents per pupil per year." A class of girls in the grammar department used Sanders High School Reader fourteen years. That is, more than 600 different girls during those fourteen years used the same identical text-books, which were purchased by us for less than $45, but would have cost each of them at the lowest term they could have bought them ($1.25 each) the sum of $750.

2. Saving of time. All pupils are furnished with suitable books on the first day of school, and can therefore be ready to recite the first day.

3. Increase of attendance in the higher grades.

4. Poor children are in so far placed on an equal footing with the rich.

5. It is an educational force in teaching responsibility for and care of property.

6. It gives school authority complete control of the course of study and removes a common excuse for non-performance of work.

In closing, allow me to refer to one other aspect of our school matters. How many before me, school officers or patrons, are in the habit of visiting the school room, or know anything of the progress your children are making, or of what is going on except by rumor from some pupil? Is this as good common sense as you use in other business transactions? Are you not often imposed upon for want of this personal knowledge?

Miss Flora McFlimsy crowds all sail. Pupils are rushed through the book without understanding or remembering the work passed over. The term closes, and with a flourish of trumpets she leaves. Miss Faithful takes her place. To her dismay, she finds the work must all be done over again. She is discouraged. The pupils wonder why they have to work so hard, and yet do not make the progress they did with the former teacher. Soon words of dissatisfaction reach her ear from parents that have never entered the school room and know nothing of the work accomplished. Her term closes, and your verdict is: "She don't amount to much."

Do not let a few dollars per month shut out the long tried and successful teacher. The best are cheap at any price, while the poor are very dear at any price.

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THOUGHT CULTURE.

BY MRS. T. C. ANTHONY.

Read at the Albion Institute, February 20, 1889.

* * * * How are we, whose lives are crowded so full of duties, to get time for thought and mental improvement?

In the first place, it seems to me that the question involves an erroneous idea, viz.: The notion that thought culture, the true student-life, is of necessity something separate and apart from the ordinary duties and industries of life, and by nature incompatible with them.

I think a moment's reflection will remind us that the great students and thinkers of the world have not arisen among people of elegant leisure. The sparkling wit and wisdom of Dr. Holmes has found time to record itself undimmed by the prosaic routine of a professor of anatomy and physiology in Harvard College, while more than one authoress of repute has performed her literary work literally amid the hurries and worries of domestic labor. Marion Harland says, in the current issue of the North American Review: "Among the best-ordered households in this and other lands are those of literary women. I believe the exceptions to the rule to be extremely rare, notwithstanding popular prejudice on this head. The drill of studious application to a given subject, of logical thought, and methodical division of time, tells in this as in every department of labor."

The problem is not how to do away with the necessity of labor, but how to so lighten and vivify labor by the power of thought, that the two shall work hand in hand together, and physical and mental faculties be evenly balanced. So work becomes not a curse but a blessing, although it is as true as ever, that "all work and no play makes Jack a dull boy."

It is not enough to be industrious; so are the ants. For rational beings it needs that the object of industry be a good and useful one. The desire to acquire riches, as a means and not as an end, is undeniably a good one, and the only question arising is whether it can be done without the sacrifice of something else of greater value. Now, there are two ways of becoming rich; one, the usual method, by conforming to the conventional laws of society and amassing sufficient money to enable us to purchase all the comforts of which men think they have need; the other, a simple and more expeditious process, by limiting our desires to the things that are really necessary. Said Socrates: "How many things there are that I do not desire." In the language of one who was in an eminent degree the apostle of plain living and high thinking, Henry David Thoreau, "A man is rich in proportion to the number of things which he can afford to let alone." Thoreau demonstrated by actual experiment that by working about six weeks in the year he could meet all the expenses of living in that simple way, which was his life-long protest against the luxury and extravagance of the age. The key-note of his life, as of his book, "Walden," is expressed in Goldsmith's words: "Man wants but little here below," with the difference that Thoreau did not merely talk of Arcadian simplicity in the manner that was so common with literary men a century ago, but carried his theories into practical effect.

In 1845 he built a hut for himself on the shores of Lake Walden, where he lived two years in seclusion, or as he himself expressed it, in "that glorious

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society called solitude," pursuing his studies as a naturalist and gathering material for literary work.

His furniture at Walden consisted of a bed, a table, a desk, three chairs—"one for solitude, two for friendship, three for society"—a pair of tongs, and a few plates, knives, forks, and cooking utensils. He had, at one time, three pieces of limestone on his desk but, finding they required to be dusted every day (you see he was a neat housekeeper though literary), he threw them out of the window, preferring to spend the time in dusting the furniture of his mind. When dining with a friend, as he did upon rare occasions, he was asked what dish he preferred, he replied "the nearest," and seemed surprised at the anxiety people usually manifest to have new and unpatched clothes rather than a sound conscience.

I do not quote this gifted and aspiring man as an example to be followed literally, but I do say that somewhere between this extreme on the one hand and the extravagance he condemned on the other, there is a golden mean for which earth's toilers, whether in field, workshop or household, should ceaselessly strive: First, by reducing our social requirements to the limit of what can be afforded without undue absorption of all the energies in the procuring; second, by method in both labor and thought.

Method and habit are labor-saving machines which we cannot afford to do without. They are inexpensive and invaluable. A routine of business established, and the tools connected with it in place, the worker can go through the detail a thousand times not only without mistake, but almost without a thought, while the mental energy thus left free may busy itself with a train of thought quite foreign and with no detriment to the business in hand. Then, when this opportunity occurs, if we are methodical in our mental arrangements also, we will have ready some subject of thought stored away for the occasion, and pursue it instead of wasting our time in worrying over past troubles that cannot be helped or future evils that may never come. It is to be admitted that a train of thought under these circumstances is liable to interruptions, especially with the busy housewife and mother. The baby may enter a noisy protest; the little boy may fall and raise a new phrenological bump on his cranium, whose ache none but a mother's touch can heal; a larger specimen of undeveloped manhood may burst in with a fearful rent in an essential garment. But, though discouraging, even this may not prove absolute defeat. Just stick a pin into the thought in your mind and fasten it to the work you were doing and when you return to the one you will find the other also. We are all acquainted with the facility with which circumstances and places will recall the thoughts with which we were occupied when in the same locality or under similar circumstances.

An instance of this kind once occurred in the experience of Dr. Holmes, somewhat to his discomfiture. He had lectured in Hartford, Conn., and was invited to meet Mrs. Sigourney at tea. She pleasantly referred to his wanderings. "Yes," he replied, "I am like the Huma, the bird that never lights, being always in the cars, as he is always on the wing." Years elapsed. Again he visited the same place for the same purpose. Another social cup after the lecture, and another meeting with the distinguished lady. "You are constantly going from place to place," she said. "Yes," he answered, "I am like the Huma"—and finished the sentence as before. What horrors, when it flashed over him that he had made this fine speech, word for word,

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twice over. Yet he declares that it was not true, as the lady might fairly have inferred, that he had embellished his conversation with the Huma daily during that whole interval of years. On the contrary, he had never once thought of the odious fowl until the recurrence of precisely the same circumstances brought up precisely the same idea. He ought to have been proud of the accuracy of his mental adjustments.

To help to furnish seed and food for thought is one object of this institute and of its humbler relatives, the farmers' clubs and literary societies, that are springing up so numerously throughout the country. Another object is to provide a place where we can display and compare the various thought plants we have reared. To be able to do this in a spirit of friendly emulation, untouched by envy or prejudice, is a triumph of social as well as mental culture.

Other benefits arising from these societies are the breaking down of the spirit of caste, too prevalent even in country neighborhoods, and moderating the rigor of social requirements in some desirable ways. Said a lady in my hearing not long since, "I think one good thing that our society has done is the bringing us acquainted with people not belonging to our church or our immediate social circle whom we would not otherwise have known, and whose acquaintance we have found both pleasant and profitable." Then the little picnic suppers indulged in by these societies, restricted to plainness by good sense and a regard for the means and convenience of all, have been so enjoyable that people have realized their advantage over more elaborate entertainments for all ordinary occasions. Indeed, even fashionable society, so called, is becoming sensible upon this point. Says a lady who has been all her life "in the swim," "It is not nearly so much work to entertain now as it was 15 or 20 years ago; why, in those early years of my housekeeping I didn't think I could give a little tea party and do with less than four or five kinds of cake, but now no more than two kinds is thought allowable, and to provide but one is not considered at all shabby." Truly straws show which way the wind is blowing. So when riches have been attained by reducing our desires to our means, method arranged that shall allow thought culture the best possible scope, there need be no fear that the "higher education" should unfit anybody for the duties of life. It is not learning but the lack of learning and what learning does for the whole being that does this. The end of thought is to correct all defects that thought reveals, and, however high our aspirations may soar, however wide our thought explore the earth or the heavens, we shall not float away on a cloud, but, steadied by a ballast of common sense and practical duties, keep our feet firmly planted on the earth.

PIN MONEY.

BY MRS. ALLEN DUNN.

Read at the Brooklyn Institute, February 15, 1889.

How should the farmer's wife provide herself with pin money, is a question that has vexed farmers' wives greatly, and is far from being settled.

Various are the devices tried. There is the poultry. How many women start out in the spring with glowing visions of the money they will make raising poultry, but only to meet with disappointment at every step. We

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think we will raise some early chickens, and succeed in getting a few hens set where we think they will not be disturbed, but there comes a snow storm, and when we can get to the henhouse, we find that the snow has driven in, and driven out our setting hens, and the eggs have a snow bank to keep them warm; so ends our early chicken venture. When we do finally get a nice lot of chickens later on, we think now we are sure to make some money. But we find that even counting chickens after they are hatched, is uncertain business. There are the hawks in the day-time, and the owls and rats at night, and the whole list of chicken diseases, from gapes to cholera, to contend with, and if we have any chickens left to sell when fall comes we are very fortunate. Of course the eggs from the farm are, or should be, quite a source of income for someone, and the women generally claim them.

Another source is the butter, there seems to be a general feeling, at least on the part of the women, that that, too, belongs to them; indeed I have heard women declare that if they could not have the butter money they would not make the butter. I often wonder what they would do if they lived in a dairy country, where butter was the main source of income from the farm. Would they still insist on having every cent of the butter money? There is once in a while a woman who makes a success of keeping bees, and loads her pockets with pin money from that source, if we are to believe the newspapers, but I confess that I never happened to have the acquaintance of even one such; they always live away off somewhere.

Another method of raising money that has been very highly recommended for women of leisure, like farmers' wives, is the raising of silk worms. I have given the matter some study and have found that those who recommend it are usually those who have some silk worm eggs to dispose of, and the honest advice of those who have tried it usually is, *don't do it.* There is too much work about it for any one who has anything else to do, and then there is the uncertainty of a market when you are done.

Another way that I have seen recommended for filling the pocket-book is to take an agency for some useful article or book. I have not tried it myself, but should not have much faith in it as a source of income, and then, too, who would be looking after the home affairs, getting the meals, making the butter, caring for the children and other such trifles, while the woman of the house was canvassing.

I suppose there are some women who do make some money by the raising of small fruits and even vegetables, but I think they are usually women who have more leisure time at their command than the average farmer's wife. Last spring I heard a woman say that she must do something to make some money, so she was going to try raising onions. As she does alone all the indoors work incident to a farm of a hundred and sixty acres, and usually raises from two hundred to five hundred chickens and turkeys, I shall be anxious to know how she succeeded. I have not seen her to learn the result.

We have thus briefly gone over some of the various sources of income supposed to be the legitimate field of the farmer's wife, from which to supply herself with pin money, which means, as I take it, the money with which to get what she needs.

Now it seems to me this whole question is looked at from a wrong standpoint. A man and his wife are partners in business, and can have no separate interest; whatever is for the best good of one, must be for the best good of the other. Selfishness, which is the bane of all our lives, should

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find no place between them. There should be no mine and thine, but they should both feel that each has an interest in all that interests the other. I think there should be a common fund for the necessary expense of the family, and one should have just as free access to it as the other. Then there should be a clear understanding between them as to (not his but their) business, so that they may know how much they can afford to spend and still have enough left to meet the necessary obligations; and you may depend upon it, the wife will be just as careful as the husband about any extravagance, but in order to do so, she must know just the state of their affairs, and everything in a business line should be freely talked over between them. Then, when she needs anything which she is satisfied comes within their means, simply say that it is needed and get it. Not going to her husband as though with her finger in the corner of her mouth and her eyes cast down, saying: "Could you possibly spare me a half a dollar to get a calico dress with? I don't see how I can get along any longer without one," and feeling herself more of a veritable beggar than the tramp who asks for bread at her door. Neither, I think, should she use such devices as a woman I read of a few days ago. She was not a farmer's wife, however. Her husband was very wealthy, but was very stingy to her in the matter of pin money. One day a lady closely veiled and very anxious not to be recognized, called upon him and borrowed a large sum of money, leaving her diamonds as security; it was his wife. While there may be men so small that only by some such device could they be induced to allow a wife her rights, I think they are the exception, not the rule, and that generally they are willing to give her her dues in just so far as she stands ready to take them. I think a great part of the trouble lies with the women themselves, in thinking they have no right to any money unless they manage in some special way to earn it. But is not the average farmer's wife earning money all the time? Does the farmer work any harder than his wife, and is not her work just as necessary to the profitable carrying on of the business as his? Then why should she not have an equal interest with him in the disposal of the income? Some men will say, go and get what you want and I will pay for it; but we are so constituted that there is an undeniable pleasure in the handling of money, and I see no reason why the wife should not be allowed her share of this pleasure, to the extent of paying her own bills; so, as a matter of convenience, it may be as well for her to have the handling of the butter and egg money, if she needs that amount, but never with the idea that "it's mine and I will do what I please with it." I think a reform in this whole matter of handling the money would do more to make happy homes among the farmers than all the tariff reform that congress will effect in years, and would greatly help to remove the feeling of discontent with which so many farmers' wives view life on the farm.

In the discussion which ensued, Secretary Reynolds said the wife is nearly always the more economical of the two, and if either is to be sole custodian of the purse let it be the wife. President Willits thought the matter went deeper than mere convenience. It is a question of education and of womanly independence. Begin with the girls; let them have some business to manage, some money to expend, that they may acquire a training in the use of money. W. Pierce also thought it a matter of business experience. Women need practice. They should get such training that they may be able to do business in case of need. T. B. Halladay indorsed the idea of a partnership

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between husband and wife, and where both have aided in acquiring, would have all property go to the survivor.

RIGHTS OF THE FARMER.

BY D. A. SHAFFER.

Read at the Albion Institute, February 10, 1869.

Although the rights of the farmer in the past have been the last to be recognized, we are pleased to notice one more item being added to our list of rights during the present month. Agriculture has been recognized as needing a more advanced position at the seat of our government, and our bureau of agriculture has been replaced by one of more dignity and importance, a cabinet position, and the agriculturist is now to be represented in the deliberations of our executive.

Again, one of the many obnoxious laws in the interest of the few and to the disadvantages of the many, is the patent law of the United States. About the only rights the farmer has in these laws are the right to be swindled and the right to defend himself in court, in case he practice any improvement upon which some sharper has seen fit to secure a patent. Many of you here present, remember the remarks of an agent of a Hedge Fence Co., made before this club, stating that his firm had some twenty patents on the manipulations of growing, training and lopping of hedges. Now, is there a doubt in the mind of one here present, that the greater part, if not all of these twenty schemes, upon which patents have been procured, were practiced by the practical farmer of the West, before such patents were granted. But these patents may preclude the very originators of these several plans from practicing their own improvements in making a hedge. For all who have visited the West have seen hedges grown on the same plan as these patents, long before hedges were grown in the East, and most Western hedges are lopped or laid down and woven. These patent laws have led to great abuses and monopolies by re-issues in the matter of barbwire fencing and drive wells.

Still, it is equally true that our country has made advances by, and through the operation of our patent laws, unparalleled in the history of the world. But why make millionaire monopolies by re-issues. The object should be to remedy the abuses while guarding the advantages, and the rights of the farmer imperatively demand that these laws be revised.

What does an honest man want in a free country like this? Simply fair laws which protect all classes alike, and by which he may, if he will, create for himself the necessities, the comforts, nay, even the luxuries of life without interference, so long as he does no injustice to his neighbor, and in spite of the lazy and narrow coward, who is ready to destroy with dynamite what he lacks the industry to get for himself. The farmer has the right to make laws for himself and can do so by sending farmers to represent him, and not as at present, by the lawyer, merchant and saloonist. For who so well knows the wants of an agricultural constituency as one of themselves. Farmers must organize or go down under the combinations, pools and trusts which are eating our very substance. Even our middlemen, dealers and grocers combine to hold their own prices, while setting prices on our products.

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Now, if agriculture is the substructure of all business pursuits, why should things be thus? For the simple reason that we do not place enough confidence in our brother farmers or too much in ourselves to combine with a will, so that it may be possible to return the choking process to these monopolies and combinations. You ask, shall we succeed? We answer, yes, because our cause is just. If unjust, our cause might be like the success pictured by Carlyle, which runs in this wise: "My friend, if thou hadst all the artillery of Woolwich trundling at thy back in support of an unjust thing and infinite bonfires visibly waiting for thee, to blaze centuries long for thy victory on behalf of it, I would advise thee to call a halt. Fling down thy baton and say, 'in God's name, no.' Thy success, poor devil, what will thy success amount to? If the thing is unjust thou hast not succeeded—no, not though bonfires blazed from north to south, and bells rang and editors wrote leading articles, and the just thing lay trampled out of sight to all mortal eyes an abolished and annihilated thing, *success*. In a few years thou wilt be dead and dark—all cold, eyeless, deaf, no blaze of bonfires, ding dong of bells, or leading articles, visible or audible to thee again at all forever." What kind of success is that? Nay, my friends, if our cause were not just we would fling down our baton now, and in God's name say no. But being just, let us organize and demand our rights.

Mr. Maynard presented some points on the need of organization, with reference to a petition to the legislature asking for the passage of the bill on beef inspection. Thinks the dressed beef monopoly must be met by organized effort, and that inspection is a move in the right direction.

HEALTH HINTS.

BY F. J. GRONER, B. S., M. D.

Big Rapids, Michigan, February 8, 1889.

There is no occupation that so imperatively demands good health as farming, but there is no pursuit that affords better conditions for good health. The out-door life, contact with nature, uniformity of hours for labor, food and repose, absence of the worry and haste of the professional and business man, all these are strongly conducive to health. The farmer does not have to contend with the poisonous germs and pollutions of the city, its impure air and water, bad sewerage and endless nuisances. He is not confined to a close room, laboring in one position, where parts of his body get no exercise. Farmers should be healthier and longer lived than any other class, and would be if they only understood and put into practice more thoroughly the laws of health.

Herbert Spencer says: "The first requisite for success is to be a good animal."

HEALTHY HOMES.

I take up this subject for the sake of the mothers and children. Man's work is in the open air, but the mother and little ones cannot escape the home. How many nervous, enfeebled children and sickly mothers find an early grave from an unhealthy home!

Eight years ago I had three cases of typhoid fever in a small country home.

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After making some investigation, I found that the cellar had been full of water all summer, and the stench from the damp, mildewed mud hole that remained explained the cause of the plague.

PURE AIR.

You probably have heard the student's definition of disinfectants: "They smell so bad that people open the door, and fresh air gets in." Since the atmosphere is 45 miles high, there is no need of breathing air a second time. In a newly settled community we cannot expect all of the modern improvements in the way of ventilation. However, we can have plenty of fresh air. And we often find the farmer healthier in his log cabin than after he has built his new house, in which carpenters and masons have managed to shut all bad air in and all good air out. The first thing to be looked after, in ventilating, is to provide some means for the bad air to get out. It is an easy matter to let pure air in. The open fire grate is one of the simplest and best means of disposing of impure air, and where fuel is so abundant one or two should be in every house.

If your bedroom is arranged so there is but one window, have it slightly open during the night. Do not be afraid of night air. You will be more likely to catch cold in an illy ventilated room than in one that lets in the night air. I have had considerable experience in night air during the past nine years, having ridden fifty miles in a single night, and I have my first cold to catch by a ride in the night air.

A man can live a long time without food. He can live a long time without drink. But, a very few moments without air will terminate his life.

I will give you some idea of the minute machinery of the lungs when I tell you that each air cell if from one-seventieth to one-two hundredth of an inch in diameter that there are 17,000 such cells around each terminal bronchus; there are 600,000,000 in the entire lungs, and the estimated surface of the lungs for æration is 80 to 100 times the estimated surface of the body, *i. e.*, 25,000 square inches is the estimated average surface of the body. This multiplied by 100 equals 250,000 square inches lung surface. The thickness of the tissue between blood and air is one-three-thousandth inch. Certainly such extensive and delicate structures need pure air. These delicate tissues not only take the oxygen from the air, but they throw off poisonous constituents from the blood, so that air breathed once is unfit for further use. It is for this reason that every bedroom should be ventilated. In the night, life processes are lowest; if you then breathe poisonous gases it gives the tubercular bacillus and other disease germs a chance to fortify themselves in the delicate structures and begin to propagate, and you soon find yourself the victim of that dread disease, consumption.

BREATHING.

In connection with the study of respiration, very naturally comes the care of the skin. Many poisons that are not removed by the lungs are excreted by the skin. Did you ever know a man to wear his flannels a month and turn them wrong side out to wear them clean, and at the end of another month return them? I did! Did you ever know a man not to bathe for a year? I did.

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There are about 2,000,000 little sweat glands on the surface of the body, and it is very essential to good health that these be kept open and in a healthy condition. You should have at least one bath a week, but one a day is a great deal better.

The poet has so beautifully presented some of these points, and as this poem has not reached the general public, you will indulge me in reading it.

THE SKIN.

BY SIR ALFRED POWER.

There's a skin without and a skin within,
A covering skin and a lining skin;
But the skin within is the skin without
Doubled inwards, and carried completely throughout.

The palate, the nostrils, the windpipe, and throat
Are all of them lined with this inner coat,
Which through every part is made to extend—
Lungs, liver, and bowels, from end to end.

The outer skin is a marvelous plan
For exuding the dregs of the flesh of man;
While the inner extracts from the food and air
What is needed the waste in his flesh to repair.

While it goes well with the outside skin,
You may feel pretty sure all's right within;
For, if anything puts the inner skin out
Of order, it troubles the skin without.

The doctor, you know, examines your tongue
To see if your stomach or bowels are wrong;
If he feels that your hand is hot and dry,
He is able to tell you the reason why.

Too much brandy, whisky, or gin,
Is apt to disorder the skin within;
While, if dirty or dry, the skin without
Refuses to let the sweat come out.

Good people all! have a care of your skin,
Both that without and that within;
To the first you should give plenty of soap,
To the last little else besides water, we hope.

But always be very particular where
You get your water, your food, and your air;
For if these be tainted, or rendered impure,
It will have its effect on your blood—be sure!

The food which will ever for you be the best
Is that you like most, and can soonest digest;
All unripe fruit and decaying flesh
Beware of, and fish that is not very fresh.

Your water, transparent and pure as you think it,
Had better be filtered and boiled ere you drink it,
Unless you know surely that nothing unsound
Can have got to it over or under the ground.

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But of all things the most I would have you beware
Of breathing the poison of once breathed air;
When in bed, whether out or at home you may be,
Always open your windows, and let it go free.

With clothing and exercise keep yourself warm,
And change your clothes quickly if drenched in a storm:
For a cold caught by chilling the outside skin
Flies at once to the delicate lining within.

All you who thus kindly take care of your skin,
And attend to its want without and within,
Need never of cholera feel any fears,
And your skin may last you a hundred years!

FOOD.

The ancient philosophers located the soul in the stomach; later it was located in the heart; but after Harvey and others demonstrated this organ to be nothing but a lump, the soul was located in the cranium. However, I am inclined to think that the ancient philosophers were right. For it is truly said that dyspepsia and religion do not go well together, but good digestion and holiness are twins. A holy man is a healthy, whole man, with all the functions in good order. Dyspepsia is the remorse of a guilty stomach, a physiological sin. Good digestion is more to be desired than great riches.

Man in some respects resembles a plant. He carries his soil in his stomach, which is a kind of portable flowerpot, and he grows round it, instead of out of it. He differs from the plant in having a complex nutritive apparatus and a nervous system.

What is a food to one person may not be a food to another; and that which is a food at one time may be a poison at another time; thus to a person whose vitality is so low that more substantial foods cannot be assimilated, alcohol may be a valuable food, and such a person may be saved from death by the use of this much abused article; but to the healthy man alcohol is not a food because it prevents changes in other substances. If a healthy man takes a certain amount of beefsteak and alcohol, the latter is changed in the body and produces a certain amount of force, but the alcohol prevents the complete change of the beefsteak, and consequently the sum total of forces acquired from taking the two is less than if the meat only had been taken. The laboring man needs hearty food. A diet for a professónal or business man is not necessarily the best for one laboring hard in the open air.

The most suitable food for breakfast is milk, bread, butter, potatoes, oatmeal, or cracked wheat, and eggs, as they are rich in fat. Lean meat is a stimulant, and if partaken of at all, in the morning, it should be sparingly. There is probably no food that better fits a man for work than fat. This should be taken in a finely divided state, as butter spread upon bread, and thin sliced bacon. Good butter is an essential constituent of any meal. Many fruits and berries may be taken with profit either at or just before breakfast. Apples, oranges or grapes before breakfast are very beneficial to health. No great amount of physical exercise should be undertaken before breakfast. Pies, cakes, etc., are out of place on the breakfast table. The healthy man needs no coaxing to enjoy this meal, and you seldom hear complaint of eating too much for breakfast. I think you never would if tea,

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coffee and lean meat were dispensed with. These should come later in the day.

Stop eating when you have satisfied the demands of nature. There is a class of people who think that the great and only sin of intemperance is in drinking. Sir Henry Thompson says: "I have, for some years past, been compelled, by facts which are constantly coming before me, to accept the conclusion that more mischief, in the form of actual disease, of impaired vigor, and of shortened life, accrues to civilized man, so far as I have observed, in our own country and throughout western and central Europe, from erroneous habits in eating, than from the habitual use of alcoholic drink, considerable as I know the evil of that to be."[1]

There has been one thing established in England, and that is that cancer of the stomach attacks the higher classes and those who live well. And the poor, half-starved beggar, eking out a miserable existence on a crust and water, can congratulate himself that his enforced abstinence saves him from many horrible diseases from which his more fortunate and well-fed neighbor suffers. The very ability of the rich man to procure and devour so many of the "good things of this life," proves a dangerous power.

Now I would not have you become one of that class of health-book reading, always talking, forever dieting people who never eat half enough, and whose lack of health is a perpetual agony and wonder to themselves. Neither would I have you belong to that still larger class who are anaconda-like in their table habits. They forget that the sense of taste lies only in the mouth, and that it may call for more long after the stomach cries enough. With this as with many things else there is the happy golden mean.

A great many Americans suffer from the effect of bad cooking. It may not sound well, but the fact remains that a great many young ladies consider it beneath them to learn to cook and especially to practice the art after they are married. It is easier to hire a kitchen girl; but from the fact that the kitchen girl is a hireling she shuns the work as much as possible, and is simply concerned in getting something on the table, no matter in what condition, and specimens of very inferior cooking disgrace the table.

Every wife should be capable of superintending the culinary department. (Did you ever know a man to succeed in business who could not lead, and who did not spend his time superintending his business?) Give us more good cooks and there will be fewer children with stomach aches, fewer people with torpid livers, less demand for bitters to tone up the stomach, fewer men seeking saloons to drown their dyspepsia, and doctors and undertakers will grow poor. Americans grow old early and die young, and one of the prime causes is that their home cooking is not fit for man or beast. Using statistics in the rough, we say one-half of the children born, die before the fifth year. We find among the chief diseases causing this frightful mortality are bowel troubles and convulsons from bad food.

"DOCTORING."

Do not resort to patent medicines and all sorts of nostrums. I can boldly express the opinion that communities are over-dosed. The best proof of it is that no families take so little medicine as those of the doctors and drug-

[1] Popular Science Monthly, vol. 27, page 333.

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gists. Nature is a great physician; do not be afraid to trust her. Remember the doctor is a pillar of society. He can kill with powder, without shot, and his drops are almost as dangerous as the hangman's.

You must not trust too much to physicians. They are only mortals, and not infallible. Did you ever see one assume the wise look of an owl, and in a ministerial tone, tell the dear friends that the lesion was incurable, that death was inevitable, that he had done all that mortal man could do, that science and skill were exhausted, and that the angels would soon claim their own, and it was useless to give any more medicine, and with crocodile tears on his cheeks, take his departure; and the patient got well without a doctor? I did.

If you are not well you need fresh air, perhaps, change of air, attention to diet, good and appropriate food judiciously regulated. Few people possess either the leisure or inclination to inquire into the merits of medical men, and the bombastic charlatan captures them with an ease unknown to physicians of finer sensibilities. You should look for capacity and select an educated, trained ingenious, industrious, and in every way competent and upright medical man.

Do not be afraid of work; it is not work, but worry, bad air, bad food, rapid eating, late nights and other irregularities that cause premature oldness.

NEEDLESS EXPOSURE.

To offset the irregularities and unnatural life of the city, we have the carelessness and indifference of the farmer to exposure. He will work all day with wet feet, or for hours in the rain, or when there is a sudden change of temperature in spring or fall he will not think of adding more clothing. You should guard against getting wet. Supply yourself with rubber coat and boots. They are cheaper than doctors' bills. Change your clothes as soon as possible after getting wet. Put on flannel underclothes in early fall. They are the most wholesome. They act like a sieve to permit the ready escape of the poisonous emanations of the body. They should be changed often, otherwise they become saturated with excretions from the body and practically lock up the pores of the skin, and prevent the necessary perspiration, and thus poison the system, aside from the offensive exhalation.

There should enter into the education of all, the study of anatomy, physiology and hygiene, even to the exclusion of some other branches.

Dr. Wayland says: "All the happiness of man is derived from discharging, applying or obeying the laws of his Creator, and all his misery is the result of ignorance or disobedience."

CIGARETTES.

Time forbids my attacking those two great detriments to good health, tobacco and alcoholic drinks. But let me point out something that threatens even to rival the liquor traffic in its pernicious influence on the rising generation, and that is cigarette smoking. The fumes are inhaled into the lungs, the blood is poisoned, the nervous system is affected, and the system is a wreck. Accumulative evidence shows the evil so gigantic that proper ordinances should be enacted forbidding the sale to boys.

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SLEEP.

"Tired nature's sweet restorer, balmy sleep." Take it in abundance. The great conservator of nervous force, and recuperator of animal machinery. I like Saxe's sentiment:

"God bless the man who first invented sleep,"
So Sancho Panza said, and so say I;
And bless him also that he didn't keep
His great discovery to himself; or try
To make it—as the lucky fellow might—
A close monopoly by "patent right."

Yes, bless the man who first invented sleep;
(I really can't avoid the iteration),
But blast the man, with curses loud and deep,
What e'er the rascal's name, or age, or situation,
Who first invented, and went round advertising
That artificial cut-off—early rising.

So let us sleep, and give the Maker praise.
I like the lad, who, when his father thought
To clip his morning nap by hackneyed phrase
Of vagrant worm by early songster caught,
Cried: Served him right! it's not at all surprising,
The worm was punished, sir, for early rising.

Let the children sleep, do not wake them in the morning, you will add much to the strength of the nervous system in later years by giving them plenty of sleep. Do not overtax yourself so the nervous system refuses to let you sleep. Do not get into the condition of one who said:

"Methought, I heard a voice cry, 'Sleep no more!
Macbeth does murder sleep,' the innocent sleep
Sleep that knits up the ravell'd sleeve of care,
The death of each day's life, sore labor's bath,
Balm of hurt minds, great nature's second course,
Chief nourisher in life's feast."

In conclusion, we may say that in a healthy home in a healthy locality, with plenty of pure air, pure water applied externally and internally, good food properly cooked, plenty of labor to occupy body and intellect, regular hours for labor, meals and sleep and proper clothing, you can lie down every night and say:

"Come gentle sleep! attend thy votary's prayer,
And through death's image to my couch repair;
How sweet, though lifeless yet with life to lie,
And without dying, O how sweet to die."

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MICHIGAN STATE AGRICULTURAL SOCIETY.

PROCEEDINGS AND AWARDS FOR THE YEAR 1889.

OFFICERS.

PRESIDENT—T. W. PALMER, Detroit.
TREASURER—A. J. DEAN, Adrian.
SECRETARY—J. C. STERLING, Monroe.
CHAIRMAN EXECUTIVE COMMITTEE—A. O. HYDE, Marshall.

EXECUTIVE COMMITTEE.

Terms expire January, 1890.	Terms expire January, 1891.
EUGENE FIFIELD, Bay City, Bay Co.	WM. BALL, Hamburg, Livingston Co.
D. W. HOWARD, Pentwater, Oceana Co.	JNO. C. SHARP, Jackson, Jackson Co.
H. O. HANFORD, Plymouth, Wayne Co.	F. L. REED, Olivet, Eaton Co.
M. J. GARD, Volinia, Cass Co.	N. J. KELSEY, W. Le Roy, Calhoun Co.
A. F. WOOD, Mason, Ingham Co.	H. R. DEWEY, Grand Blanc, Genesee Co.
FRANKLIN WELLS, Constantine, St. Jos. Co.	I. H. BUTTERFIELD, Lapeer, Lapeer Co.
J. Q. A. BURRINGTON, Tuscola, Tuscola Co.	JOHN LESSITER, Cole, Oakland Co.
M. P. ANDERSON, Midland, Midland Co.	JAMES M. TURNER, Lansing, Ingham Co.
L. D. WATKINS, Manchester, Wash. Co.	J. P. SHOEMAKER, Amsden, Montcalm Co.
C. W. YOUNG, Paw Paw, Van Buren Co.	F. HART SMITH, Somerset, Hillsdale Co.

EX-PRESIDENTS.

M. SHOEMAKER, Jackson, Jackson Co.	HENRY FRALICK, Grand Rapids, Kent Co.
CHARLES KIPP, St. Johns, Clinton Co.	PHILO PARSONS, Detroit, Wayne Co.
E. O. HUMPHREY, Kalamazoo, Kalamazoo Co	WM. CHAMBERLAIN, Three Oaks, Berrien Co.
W. L. WEBBER, East Saginaw, Saginaw Co.	A. O. HYDE, Marshall, Calhoun Co.
GEO. W. PHILLIPS, Romeo, Macomb Co.	

STANDING COMMITTEES.

Business—FRANKLIN WELLS, JOHN C. SHARP, I. H. BUTTERFIELD, JAMES M. TURNER.
Transportation—JAMES M. TURNER, EUGENE FIFIELD, J. C. STERLING.
Finance—M. P. ANDERSON, F. L. REED, J. P. SHOEMAKER.
Premiums—GEO. W. PHILLIPS, I. H. BUTTERFIELD, A. F. WOOD, C. W. YOUNG, JOHN C. SHARP, JOHN LESSITER, M. J. GARD.

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Rules—H. O. HANFORD, J. Q. A. BURRINGTON, EUGENE FIFIELD.
Reception—WM. CHAMBERLAIN, A. O. HYDE, H. O. HANFORD.
Programme—GEO. W. PHILLIPS, I. H. BUTTERFIELD, JOHN C. SHARP.
Printing and Advertising—A. J. DEAN, J. C. STERLING, FRANKLIN WELLS.
General Superintendent—H. O. HANFORD.
Chief Marshal—EUGENE FIFIELD,

EXECUTIVE SUPERINTENDENTS.

Cattle—I. H. BUTTERFIELD.
Horses—G. W. PHILLIPS.
Sheep—D. W. HOWARD.
Swine—JOHN LESSITER.
Poultry—J. Q. A. BURRINGTON.
Miscellaneous—F. HART SMITH.
Art—M. P. ANDERSON.
Music—M. P. ANDERSON.
Children's Departm't—WM. CHAMBERLAIN.
Needle Work—WM. CHAMBERLAIN.
Manufactures—HENRY FRALICK.
Agricultural—H. O. HANFORD.
Machinery—H. R. DEWEY.
Farm Implements—C. W. YOUNG.
Dairy Department—J. P. SHOEMAKER.
Vehicles—F. L. REED.
Bees and Honey—M. J. GARD.
Forage—A. F. WOOD.
Horticultural—L. D. WATKINS.
Gates—WM. BALL.
Police—N. J. KELSEY.

PROCEEDINGS OF THE EXECUTIVE COMMITTEE WINTER MEETING.

FIRST DAY.

THE WAYNE, DETROIT,
January 14, 1889.

The regular annual meeting of the Executive Committee of the Michigan State Agricultural Society opened in the parlors of The Wayne, in the city of Detroit, this evening, the President, A. O. Hyde, in the Chair.

The President read a letter from President-elect Palmer, stating that it would be impossible for him to attend the meeting at this date.

The roll was called. The following members answered to their names:

President Hyde, Messrs. Hanford, Lessiter, Sharp, Smith, Burrington, Wood, Shoemaker, J. P., Gard, Young, Butterfield, Watkins, Wells, Phillips, Fralick, Parsons, and the Secretary.

President Hyde then read his address.

PRESIDENT HYDE'S ADDRESS.

The Fortieth Annual Fair of the Michigan State Agricultural Society was held on Jackson County Fair Grounds at the date advertised.

The resolution passed at our last winter meeting, offered by Jackson County, was considered by other localities as so far fixing the place for holding our next Fair, that no other proposals were offered. Under this state of things the committee in charge had only the one locality to advise with, and got such terms as they could. Under the circumstances the bargain seemed a fairly good one. We find in closing the year, our situation to be very nearly as follows, financially:

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January 14, 1888.	Balance on hand	$3,839 06
" " 1889.	Receipts of current year	16,432 75
		$20,271 81
Disbursements for the year to date		19,501 61
		$770 20
Outstanding debts		200 00
Net balance on hand		$570 20

This showing makes a shrinkage of late years that very nearly lands the Society where money ceases to be among the articles on hand. The question may be properly asked what has led to this state of things. The general watchword has been, we must economize by cutting down expenses, etc. This course has been thoroughly pursued, and still the shrinkage increases. The Business Committee being governed by the expressed views and feelings of the Executive Committee and their own judgment, have reduced expenses of preparation for the Fair to the lowest possible sum. This season's expenses of preparation have been much less than ever before in the history of the Society. Have we gained or lost by this course? All looking and working for the welfare of the Society we represent, will see at a glance the pertinence of this question, and the propriety of such discussion as may tend to lead us toward prosperity in the future. Our exhibitions have been well advertised, not only at our own expense, but have been aided by the railroads of the State. The people seem to be looking for something new; they say we must get out of the old rut. If the grumblers would give their time and money and impart to us some of their pent-up wisdom, we might then get out of the old rut. All participants and visitors to the last State Fair, so far as seen, pronounce the Fair a success in all its departments. Taking our various well-filled and well-arranged halls, our great and well-managed implement department, together with our numerous live stock departments, all running full to the brim, without friction, and certainly no one could call it a poor or small show. Right here let us look for a moment at our organization composed of skilled workmen. Our superintendents, thoroughly educated to their work, take their departments when the Fair opens, and the most rare thing heard on the grounds is a complaint or even a murmur. It is much more trying to patience and temper in some of our departments than others. The Superintendent of Gates, for instance, finds himself in a warm latitude, regardless of the position of the mercury, where nothing short of the smooth surface of a *Ball* could ward off the constant attack.

The fact has been clearly demonstrated over and over that in order to make a show or exhibit successful, it must be made attractive. At various times we have tried special exhibits, chariot races, equestrianism, special speed department, military display, etc., all with a view to meeting and suiting the tastes of all, so far as we could. Much good judgment must be put in play to secure the necessary variety and at the same time fully sustain the dignity and good standing of the Society we represent.

We find through correspondence and personal interviews with those interested in the management of large exhibitions—State and otherwise—a good deal of criticism on what outsiders term in some cases our "close communion" mode of excluding exhibits of stock from other States from

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our premium list. We are aware that this question has two sides. There is no doubt about our committee having acted upon their honest conviction in adopting their present policy. It is our opinion, however, that if the time shall come when they shall see fit to open their exhibition to the whole country, they will greatly add to the standing of the Society as a State institution.

We find after our Society (one of the oldest State Societies) has reached the age of forty years, that we are surrounded by great and important changes, and great progress in every department. In the animals offered for exhibition, we find lineage the first requirement. While the individual is not entirely lost sight of, his value is greatly enhanced by being so bred that he is entitled to enrollment in the herd book of his family.

It is good policy to so frame our exhibitions that our patrons have the opportunity to see as much as possible of the best in every department, whether owned in Michigan or any other State. In other States the exhibition of stock is as broad as the exhibition of implements.

In choosing implements for the farm or workshop, our citizens have the advantage of seeing all new improved machinery and farm utensils. Why not allow them the same advantage of seeing and choosing from the stock of the whole country? Quite sure are we that Michigan stock-growers would not suffer in the least by a comparison of their stock by the side of any that could be produced.

The question of location is a very important one for your consideration. The migratory plan has about exhausted itself. Most of the desirable locations in our State are now so largely interested in local fairs, that they hardly feel like breaking up present connections for any chances that might accrue to them from booming the State Fair. The question of permanent location has received some attention, so far as appointing a committee. Very little can be done by a committee until they find somebody to confer with. If anything can be done in this direction, it must be done with localities that have already become large commercial centers, with numerous railroads or waterways for carrying purposes, surrounded by large populations. The large population of our largest cities are to a great extent patrons of exhibitions in their midst. When the State Fair was held in Detroit, our receipts were greatly enlarged by the different associations, trades, etc., each selecting a day, and then all turning out.

The Society had its own selection of week last year. No open antagonism existed to our dates. We had good weather, and after all these favorable surroundings, but one day of good receipts. The lack of attendance cuts down any disposition to invest in booth or show privileges. We have been in the habit of looking to this now limited source for much larger financial aid in years gone by. It is easy to see that our shortage is not all at the gates.

During the past year one of our oldest and most reliable members has gone to his rest. We refer to the Hon. Witter J. Baxter. We shall feel his loss in our councils. His death will be more fully noticed during this meeting.

The Hon. H. C. Sherwood, the valued President of the West Michigan Society, has also been taken away—a much esteemed gentleman, and a personal friend of some of our members. His death will also receive further notice.

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We have very little to say in the line of recommendation. The committees, without doubt, will be arranged about as usual. The Committee on Rules is a very important one. A careful discharge of their duties has much to do with the success of the Society. Useless rules should be thrown out, any rules conflicting with the Constitution or By-Laws should be so modified that all will harmonize.

In closing our brief remarks, it is with pleasure that we refer to the able and faithful manner in which our officers and superintendents have discharged their duties—duties ever varied by a constant change of circumstances—at times pleasant, at other times very trying; calling for cool, well-balanced judgment. It is here we see and realize the working of the well-tried system under which our State Fair management is conducted, each department being entirely in charge of its own superintendent, and dependent largely on him for success. The superintendent that can so manage his department as to make it satisfactory to exhibitors and visitors, adds directly to the strength and popularity of the Society.

The Marshal's department is an important factor in the general supervision of business incident thereto. We watched with admiration the promptness with which the business of this department was attended to at the last Fair. The chief and his able assistants were always at hand in the right place to keep work moving along.

In handing over to my successor as President the mantle of office that has rested on my unworthy shoulders for a brief time, I take peculiar pleasure. His eminent fitness for the place is so clearly to be seen that all will say, Amen!

Gentlemen of the Executive Committee, allow me to tender you my heartfelt thanks for the unvarying courtesy with which you have treated me while presiding over your deliberations.

The Secretary then read his report, as follows:

SECRETARY'S REPORT.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—I would respectfully submit the following, the Secretary's report for 1888:

The disbursements during the year were as follows: Business orders, drawn for the payment of accounts audited by the Business Committee, numbering from 1 to 223 inclusive, amounting to $8,785.61; a record of the same will be found in the register and upon the stubs of the orders. The accounts corresponding with the orders are held by the Secretary as vouchers, and are on file in his office.

The details of the general expenditures of the Society have been classified and arranged under the proper heads, and the items will be found in the report of the Business Committee.

Three hundred and ninety-four checks were drawn on the Treasurer for premiums awarded at the Fortieth Annual Fair. They amount to $10,539. In addition to these, five checks amounting to $177, for protested premiums on exhibits of 1886 and 1887 were issued, making the total amount of premium checks issued during the year $10,716.

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A complete list of checks issued for premiums will be found in the schedule accompanying this report.

The following table will show the amount of cash and number of medals and diplomas offered and awarded in each division.

CASH PREMIUMS.

Divisions.	Offered.	Awarded.
A—Cattle	$3,235 00	$2,857 00
B—Horses	5,008 00	3,327 00
C—Sheep	1,519 00	1,317 00
D—Swine	835 00	707 00
E—Poultry	377 50	158 00
F—Farm and Garden Products	471 50	356 00
G—Dairy Products	174 00	113 00
H—Bees and Honey	188 00	177 00
L—Manufactured Goods	436 00	151 00
M—Musical Instruments, Jewelry, etc	22 00	2 00
N—Art	875 00	727 00
O—Needle and Fancy Works	326 50	197 00
P—Miscellaneous	106 00	28 00
Q—Children's Work	50 50	29 50
R—Horticulture	952 00	392 50
Total	$15,178 00	$10,539 00

MEDALS AND DIPLOMAS.

Divisions.	Medals.		Diplomas.	
	Offered.	Awarded.	Offered.	Awarded.
D—Swine			6	6
L—Manufactured Goods	1		1	
M—Musical Instruments, etc			7	
N—Art			1	
O—Needle and Fancy Work				
P—Miscellaneous	2		1	
Total	3		16	6

ENTRIES.

The following is a list of entries in each class and division:

DIVISION A—CATTLE.

Class.		
1—Shorthorns	88	
2—Devons	28	
3—Herefords	48	
4—Jerseys	106	
5—Galloways and Polled Angus	42	
6—Holstein-Friesians	99	
7—Grade Cattle	40	
8—Fat Cattle	41	
Total		492

DIVISION B—HORSES.

Class.		
9—Cleveland Bays and French Coach Horses	36	
10—Thoroughbreds	7	
11—All Work	90	
12—Roadsters	37	
13—Breeders' Stock	45	
14—Gents' Driving Horses	23	
15—Clydesdale or English Shire Horses (registered)	27	
16—Percheron French Draft Horses (registered)	56	
17—Draft Horses	37	
18—Carriage and Buggy Horses	49	
19—Roadster Stallions to harness	37	
20—Roadster Mares and Geldings to harness	43	
21—Thoroughbreds under saddle	6	
22—Stallions with five of get	13	
Speed	10	
Total		526

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DIVISION C—SHEEP.

Class.		
23—Thoroughbred American Merinos	79	
24—Thoroughbred American Merinos, Michigan bred	83	
25—Fine Wool Grades	22	
26—Southdowns	15	
27—Shropshires	124	
28—Hampshires	21	
29—Oxfords	48	
30—Cotswolds	31	
31—Leicesters	24	
32—Fat Sheep	23	
Total		470

DIVISION D—SWINE.

33—Berkshire	31	
Essex	40	
Suffolk, Small Yorkshire and Victorias	57	
Poland-China	103	
Duroc-Jersey	11	
Chester White and other large breeds	33	
Fat Hogs	9	
Special Premium American Berkshire Association	7	
Total		291

DIVISION E—POULTRY.

34—Poultry		379

DIVISION F—FARM PRODUCTS.

35—Grain and Seeds	148	
36—Roots and Vegetables	339	
37—Display of Roots and Vegetables	3	
38—Flour, Feed and Meal	9	
Total		489

DIVISION G—DAIRY PRODUCTS.

39—Butter, Cheese and Dairy Articles	24	
40—Sugar, Bread and Pickles	66	
41—Soap, Prepared Groceries, etc.	11	
Total		101

DIVISION H—BEES AND HONEY.

42—Bees and Honey		60

DIVISION I—FARM IMPLEMENTS.

43—Plows	68	
44—Tillage Implements	82	
45—Seed Drills, Sowers and Planters	27	
46—Haying and Harvesting Implements	108	
47—Machinery for Cleaning and Preparing Crops	34	
48—Miscellaneous Farm Articles	45	
Total		364

DIVISION J—VEHICLES.

49—Vehicles		229

DIVISION K—MACHINERY.

50—Machinery for Working upon Metal and Wood	309	
51—New Machinery	13	
Total		322

DIVISION L—MANUFACTURED GOODS.

Class.		
52—Materials	1	
53—Factory made	--	
54—Articles of Dress	4	
55—Articles of Leather and India Rubber	31	
56—Furniture	35	
57—Stoves, Iron Work, etc.	35	
Total		106

DIVISION M—MUSICAL INSTRUMENTS, ETC.

58—Musical Instruments and Sewing Machines	37	
59—Philosophical and Surgicial Instruments	5	
60—Clocks, Jewelry, Plated Ware, etc.	1	
Total		43

DIVISION N—ART.

61—Painting and Sculpture, by Professional Artists	135	
62—Painting and Drawing, by Amateur Artists	57	
Total		192

DIVISION O—NEEDLE AND FANCY WORK.

63—Articles of Ladies' Dress	7	
64—Plain Needle and Machine Work	50	
65—Embroidery and Ornamental Needle Work	156	
66—Crochet, Knit and Fancy Work	103	
67—Hair, Shell and Wax Work	25	
Total		341

DIVISION P—MISCELLANEOUS.

68—Miscellaneous Articles	29	
69—Household Articles	15	
70—Printing and Stationery	--	
Total		44

DIVISION Q—CHILDREN'S DEPARTMENT.

Children's Work		67

DIVISION R—HORTICULTURE.

1—Horticultural Products	0	
2—Collection of Fruits for Family use	6	
3—Collection of Market Fruits	0	
4—Apples for Dessert or Culinary purposes	8	
5—Special Exhibit Apples	5	
6—Special Exhibit Peaches	11	
7—Special Exhibit Pears	22	
8—Special Exhibit Plums	3	
9—Special Exhibit Grapes	17	
10—Single Plates of Fruit	192	
11—Dried, Canned, Pickled and Preserved Fruits	24	
12—Plants and Flowers shown in beds	5	
13—Plants and Flowers, Professional List	6	
14—Plants and Flowers, Amateur List	15	
15—Cut Flowers, Bouquets and Floral Designs	20	
Total		339
Total Entries in all Departments		4,534

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The following moneys coming into my hands as Secretary of the Society have been paid to the Treasurer and his receipt taken for the same.

For Annual Memberships	$587 00
" Rent of Stalls	407 75
" Speed Entry Fees	475 00
" Sales Department	35 45
" Premium Money Returned	10 00
Total	$1,515 20

INVENTORY OF PROPERTY IN THE SECRETARY'S OFFICE.

Same as in last year's report, with the addition of the American Devon Herd Book.

J. C. STERLING,
Secretary.

Accepted and referred.

Mr. Wells, Chairman of the Business Committee, submitted the report of that committee, as follows:

STATEMENT OF BUSINESS COMMITTEE IN DETAIL.

WINTER MEETING.

1888.	No.	Order.		
Jan. 12.	3	E. N. Rising, expenses		$6 60
	4	Henry Fralick, "		9 50
	5	H. W. Cobb, "		9 00
	6	J. Lessiter, "		2 45
	7	Jno. C. Sharp, "		9 45
	8	L. D. Watkins, "		4 00
	9	E. Fifield, "		6 50
	10	G. W. Phillips, "		4 80
	11	A. F. Wood, "		7 20
	12	A. O. Hyde, "		10 50
	13	Wm. Ball, "		4 20
	14	I. H. Butterfield, "		3 60
	15	J. Q. A. Burrington, expenses		6 20
	16	M. P. Anderson, expenses		8 10
	17	J. P. Shoemaker, "		9 20
	18	F. H. Smith, "		5 05
	19	F. L. Reed, "		8 40
	20	Franklin Wells, "		10 40
	21	Wm. Chamberlain, "		14 57
	22	C. W. Young, "		11 15
	23	M. J. Gard, "		13 20
	24	H. O. Hanford, "		3 15
	25	Russell House, board of committee		241 50
Feb. 11.	28	A. J. Dean, expenses		4 61
	29	J. C. Sterling, "		2 55
May 5.	40	Free Press, printing proceedings		111 50
				$527 38

PRESIDENT'S OFFICE.

Sept. 15.	55	A. O. Hyde, expenses and clerk	$39 80
	70	A. O. Hyde, expenses and clerk	1 00
			$40 80

SECRETARY'S OFFICE.

Jan. 12.	26	J. C. Sterling, 3 months' salary	$250 00
May 5.	39	J. C. Sterling, 3 months' salary	250 00
Sept. 15.	61	J. H. Hanford, sec. clerk	10 40
	62	L. H. Ives, "	8 60
	63	W. H. Horton, "	16 60
	64	Albert Little, "	12 10
	65	F. Livermore, "	29 00
	66	C. J. Phillips, "	26 40
	69	W. D. Loomis, "	18 00
24.	75	Hurd House, board of secretary and clerks	66 25
	76	H. E. Detwyler, board of clerks	43 00
Sept. 24.	87	J. E. Landon, sec. clerk	$31 85
	88	Will Hubbard, "	43 50
Nov. 12.	204	J. C. Sterling, 3 months' salary	250 00
Dec. 27.	217	J. M. Sterling, rent of office	50 00
	223	J. C. Sterling, 3 months' salary	250 00
			$1,355 20

TREASURER'S OFFICE.

Sept. 26.	140	H. E. Detwyler, board of clerks	31 68
Oct. 16.	189	Hibbard House, board of treasurer and clerks	37 00
26.	199	A. J. Dean, treas. clerk	164 85
Dec. 27.	218	A. J. Dean, treas. bookkeeper	400 00
			$633 53

LOCATING COMMITTEE.

Feb. 11.	31	Franklin Wells, expenses	$7 65
	32	A. O. Hyde, "	2 65
	33	A. J. Dean, "	4 35
	34	I. H. Butterfield, "	8 60
	35	J. C. Sterling, "	4 00
	36	Hibbard House, board of committee	12 50
			$39 75

BUSINESS COMMITTEE.

May 9.	47	I. H. Butterfield, expenses	$4 00
Aug. 2.	48	Hibbard House, board of committee	4 50
	54	Franklin Wells, trip to Jackson	5 55
Sept. 15.	71	Jno. C. Sharp, expenses	3 00
	158	Jno. C. Sharp, "	3 70
	159	Franklin Wells, "	8 17
	160	Franklin Wells, "	6 40
	161	Franklin Wells, "	7 75
Oct. 16.	189	Hibbard House, board of committee and clerk	37 50
26.	196	W. H. Gilbert, expenses as clerk	9 38
Dec. 27.	220	Franklin Wells, expenses, Monroe	11 10
	221	Jno. C. Sharp, expenses, Monroe	5 25
	223	I. H. Butterfield, expenses, Monroe	7 50
			$113 80

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POSTAGE.

1888.	No.	Order.	
Feb. 11.	30	Monroe postmaster, for secretary	$5 00
Aug. 2.	49	Monroe postmaster, for secretary	5 00
	50	Monroe postmaster, for premium lists	12 00
	52	Monroe postmaster, for complimentaries	18 00
	53	Monroe postmaster, for premium lists	10 00
Sept. 15.	56	Monroe postmaster, for posters	8 00
	57	Monroe postmaster, for posters	10 00
	58	Monroe postmaster, for secretary	10 00
	59	Monroe postmaster, for secretary	11 00
Oct. 5.	187	Monroe postmaster, for premium checks	7 50
			$96 50

STATIONERY.

Dec. 27.	209	Geo. D. Brown, stationery	$3 70
	212	F. M. Meiers	22 33
	215	Payne Book Bindery, journal and ledger	6 50
			$32 53

GENERAL EXPENSE.

Jan. 2.	2	A. J. Dean, sundry trips	$56 73
	31	M. S. Smith & Co., 2 clocks for presentation	100 00
Sept. 15.	60	L. H. Ives clerk of election	2 00
	66	R. L. Hewitt, judge of election	2 00
	26. 177	Jackson Broom Co., 1 doz. brooms	3 00
	178	H. C. Ransom, use of chairs	2 00
	179	N. M. Perkins, use of stove	1 00
Oct. 12.	188	E. S. Graves, judge of election	3 00
	16. 194	J. V. DeFoe, ribbons and badges	18 16
	195	W. H. Gilbert, oils, keys	6 42
Dec. 27.	207	J. C. Sterling, attending meetings	35 07
	214	Leib & Baier, twine, tacks, etc.	3 21
	219	A. J. Dean, sundry trips	30 37
			$262 96

PRINTING AND ADVERTISING.

Aug. 2.	51	D. T. Elmer, 5,000 premium lists, etc.	$184 00
Sept. 24.	74	Will Hubbard, work for committee	24 00
	77	Calvert Lithograph Co., lithographs	75 00
	85	O. S. Gulley & Co., tickets	50 85
	26. 154	Buffalo Courier Co., lithographs	37 50
	155	Wm. Payne, committee and entry books	72 80
	156	Calvert Lithograph Co., complimentaries	16 40
	157	Adrian Weekly Press, letter heads	69 49
	185	Times and Expositor, letter heads, tickets, etc.	2 50
Oct. 16.	190	Gibbons Bros., publishing notices	75 00
	26. 200	Carlton & Van Antwerp, programmes	27 25
	201	Det. Free Press, posters	174 80
	202	Jackson Courier Co., premium cards	10 20
Nov. 15.	206	Democrat Printing Co., notices, catalogues, etc.	109 00
Dec. 27.	208	J. C. Sterling, sundry trips	11 80
			$940 09

BUILDINGS AND REPAIRS.

1888.	No.	Order.	
Mar. 14.	87	D. Doig & Son, repairs on buildings, 86	$20 50
April 4.	88	C. H. Plummer, bill lumber	37 75
Sept. 24.	81	C. E. Lathrop, " "	78
26.	167	C. P. Pond & Co. " "	60 32
	168	J. W. Fleming, lime	75
	169	R. A. Gibson, labor	1 00
	170	Pay roll, carpenter work	85 48
	171	W. H. Gilbert, freight	1 47
	172	Jackson, Filley & Co., bill lumber	117 54
	173	R. A. Gibson, water cocks	5 00
	174	Victor Sorg, repairing sky light	38 60
	175	Pay roll, carpenter's work	107 09
	176	Warner & Dodge, hardware	12 60
Oct. 26.	193	Barnard & Smith, hardware	43 26
Dec. 27.	216	Jackson County Agl. Socy., whitewashing	25 00
			$557 14

GROUNDS.

Sept. 24.	78	Pay roll. Fair week pay roll	$66 15
	79	B. J. Wood, labor	18 60
	80	Harry Howard, whitewashing	6 00
	26. 180	Chas. Eddy, work on track	25 00
	181	C. C. Pond, " " "	4 50
	182	Chas. Snyder, team on sprinkler	11 25
	183	J. C. Sharp, hauling manure	60 00
Oct. 16.	191	Buhl, Sons & Co., bill gas pipe	25 60
	26. 192	Pay roll, clearing up after fair	25 05
			$242 15

BAND.

Sept. 26.	162	Smith band, music 4 days	$175 00

POLICE.

Sept. 24.	123	W. H. Cobb, supt's expenses	1 00
	124	W. H. Cobb, " "	14 75
	125	Hibbard House, supt's board	9 50
	186	Pay roll. Police pay roll	324 25
			$349 50

MEAL TICKETS.

Sept. 24.	83	N. W. Edgar, 5 tickets	1 67
	26. 144	B. J. Wood, 166 "	55 33
	145	Moses Forsh, 4 "	1 33
	146	Bridget Lanigan, 3 "	1 00
	147	B. J. Wood, 38 "	12 66
	148	N. W. Edgar, 39 "	13 00
	149	Presbyterian Church, 56 tickets	18 66
	150	First M. E. Church, 269 tickets	89 66
	151	Baptist Church, 316 tickets	105 33
Oct. 26.	197	B. J. Wood, 6 tickets	2 00
			$300 64

FORAGE.

Sept. 24.	126	E. W. Rising, supt's expenses	$27 50
	127	E. W. Rising, " "	14 15
	128	E. W. Rising, team and men	43 00
	129	E. E. Roberts, hay and straw	1,067 75
	130	Allen Taylor, hay and straw	201 94
			$1,359 69

GATES.

Sept. 26.	136	Wm. Ball, supt's. expenses	$4 95
	137	A. E. Detwyler, board of men	21 00

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1888.	No.	Order.	
Sept. 26.	138	H. Alsover and others, board of men	$27 25
	139	Pay-roll. Gate-keeper's pay-roll	137 40
Oct. 16.	189	Hibbard House, board of supt.	10 00
			$200 60

DECORATING.

Sept. 26.	163	Jackson Paper Co., paper for Hort. Hall	$3 19
	164	H. S. Venton, banners	1 80
	165	Glasgow Brothers & Dack, mosquito bar	17 42
			$22 41

POWER.

Sept. 26.	152	Hutchinson Mnfg. Co., power for hall	$200 00
	153	Wm. Eaton, jr., power for field	60 00
			$260 00

BILL POSTING.

Oct. 26	208	Chas. Van Ostrander, posting Adrian	$1 35
Dec. 27.	211	Bill posters, posting State	87 09
			$88 44

HERD BOOKS.

Sept. 24.	73	American Shorthorn Ass'n, Vol. 33	$3 45

EXPRESS.

Dec. 27.	210	American Express Co., sundry pkgs	$40 57

TELEGRAPHING.

Nov. 12.	205	Western Union Telegraph Co.	$8 66

LIVERY.

Sept. 26.	134	A. E. Sutton, horse and buggy for com	$13 50

LADIES' COTTAGE.

Sept. 26.	142	Mrs. B. J. Wood, care of cottage	$15 00

CHECK ROOM.

Sept. 26.	143	Geo. Allen, checking baggage	$3 40

GENERAL SUPERINTENDENT.

Sept. 24.	122	Wm. Chamberlain, superintendent's expenses	$5 05

MARSHAL'S OFFICE.

Sept. 24.	131	Eugene Fifield, chief marshal's expenses	$3 25
	132	N. J. Kelsey, assistant marshal	14 50
	133	W. W. Hodge, assistant marshal	16 30
	134	H. H. Hinds, assistant marshal	19 90
	135	Frank Hodge, assistant marshal	15 20
Oct. 16.	189	Hibbard House, board of marshal and assistants	45 00
Dec. 27.	213	N. J. Kelsey, board of assistant	9 50
Sept. 26.	166	J. W. Fleming, oats	5 88
			$129 08

HORSE DEPARTMENT.

Sept. 24.	89	Geo. W. Phillips, jr., assistant superintendent	$24 50

1888.	No.	Order.	
Sept. 24.	90	Geo. Crydermore, expense as judge	$10 25
	91	B. D. Taggart, expense as judge	10 00
	92	James Davidson, expense as judge	10 25
	93	J. Van Hooven, expense as judge	9 65
	94	Geo. W. Phillips, expense of superintendent	5 45
Oct. 16.	189	Hibbard House, board of supt., ass'ts and judges	34 00
			$104 10

SPEED DEPARTMENT.

May 9.	41	Eugene Fifield, expense to attend meeting	$7 50
	42	H. J. Dean, expense to attend meeting	3 75
	43	W. H. Cobb, expense to attend meeting	9 98
	44	I. H. Butterfield, expense to attend meeting	3 65
	45	Geo. W. Phillips, expense to attend meeting	4 10
	46	Wayne Hotel, board of committees	6 00
Sept. 24.	72	American Trotting Association, annual dues	29 00
	95	W. H. Cobb, expense of superintendent	12 25
	96	A. G. Hancock, starting judge	100 00
	97	Geo. Fuller, expense of judge	2 00
	98	Hibbard House, board of starting judge	3 00
	99	Hibbard House, board of judge	6 00
	100	Hibbard House, board of judges	4 50
			$191 73

CATTLE DEPARTMENT.

Sept. 24.	88	A. J. Fisk, expense of judge	$25 00
	101	I. H. Butterfield, expense of superintendent	35 35
	102	A. J. Burrows, expense of judge	2 50
	103	W. A. Rowley, expense of judge	6 70
	104	J. C. Bertram, expense of judge	23 00
Oct. 26.	198	Richard Gibson, expense of judge	18 00
			$110 55

SHEEP DEPARTMENT.

Sept. 24.	105	D. W. Howard, judge's expenses	$28 74
Oct. 16.	189	Hibbard House, board of supt. and judges	21 50
			$50 24

SWINE DEPARTMENT.

Sept. 24.	106	A. C. Hawley, judge	$33 00
	107	Jno. Lessiter, superintendent's expenses	4 60
Oct. 16.	189	Hibbard House, board of superintendent	14 00
			$51 60

POULTRY DEPARTMENT.

Sept. 24.	86	J. Q. A. Burrington, expenses of superintendent	$27 20
	108	Daniel Jones, judge	20 00
			$47 20

IMPLEMENT DEPARTMENT.

Sept. 24.	113	C. W. Young, superintendent's expenses	$25 05

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1888.	No.	Order.	
Sept. 24.	114	H. O. Hanford, superintendent's expenses	$4 80
	115	Hibbard House, board of superintendent	4 50
Oct. 16.	189	Hibbard House, board of superintendent	17 00
			$51 35

HORTICULTURAL DEPARTMENT.

Sept. 24.	120	L. D. Watkins, assistant superintendent	$34 55
	121	C. Long & Co., plates for department	8 95
Oct. 16.	189	Hibbard House, board of supt. and asst.	21 29
			$64 79

VEHICLE DEPARTMENT.

Jan. 12.	1	F. L. Reed, expenses of superintendent, 1887	$4 80
Oct. 16.	189	Hibbard House, board of superintendent	10 00
			$14 80

AGRICULTURAL DEPARTMENT.

Sept. 24.	109	A. F. Wood, superintendent's expenses	$1 75
Oct. 16.	189	Hibbard House, board of superintendent	16 00
			$17 75

DAIRY DEPARTMENT.

Sept. 24.	110	J. P. Shoemaker, superintendent's expenses	$6 75
Oct. 19.	189	Hibbard House, board of superintendent	13 00
			$19 75

BEE AND HONEY DEPARTMENT.

Sept. 24.	111	M. J. Gard, superintendent's expenses	$20 30
	112	M. H. Hunt, judge expenses	2 50
			$22 80

MUSIC DEPARTMENT.

Sept. 24.	116	M. P. Anderson, superintendent's expenses	$12 75
Oct. 16.	189	Hibbard House, board of superintendent	3 50
			$16 25

MISCELLANEOUS DEPARTMENT.

Sept. 24.	119	F. H. Smith, superintendent's expenses	$4 50
Oct. 16.	189	Hibbard House, board of superintendent	11 50
			$16 00

NEEDLEWORK DEPARTMENT.

Sept. 24.	118	Minnie Brow, superintendent's expenses	$16 15
Oct. 16.	189	Hibbard House, board of superintendent	14 50
			$30 65

MANUFACTURER'S DEPARTMENT.

Sept. 24.	84	Henry Fralick, expense of supt. and assistant	$47 60

MACHINERY DEPARTMENT.

Sept. 15.	67	R. C. Carpenter, expense of superintendent	$26 18

ART DEPARTMENT.

Sept. 24.	117	Jas. O'Donnell, catalogues	$28 00

SALES DEPARTMENT.

Sept. 24.		A. J. Mann, auctioneer	$55 00

SUMMARY STATEMENTS—1888.

Winter meeting expenses	$527 38
President's office	40 80
Secretary's office	1,355 20
Treasurer's office	532 53
Locating Committee	39 75
Business Committee	113 80
Postage	96 50
Stationery	32 53
General expenses	262 96
Printing and advertising	940 09
Building and repairs	557 14
Grounds	242 15
Band	175 00
Police	349 50
Meal tickets	300 64
Forage	1,359 69
Gates	200 60
Decorating	22 41
Power	260 00
Bill posting	88 44
Herd books	3 45
Express	40 57
Telegraphing	8 66
Livery	13 50
Ladies' cottage	15 00
Check room	6 40
General Superintendent	5 05
Marshal's office	139 08
Horse department	104 10
Speed department	191 73
Cattle department	110 55
Sheep department	50 24
Swine department	51 60
Poultry department	47 20
Implement deparment	51 35
Horticultural department	64 79
Vehicle department	14 30
Agricultural department	17 75
Dairy department	19 75
Bee and honey department	22 80
Music department	16 25
Miscellaneous department	16 00
Needle work department	30 65
Manufacturers' department	47 60
Machinery department	26 18
Art department	28 00
Sales department	55 00
Total	$8,785 61

MONEY PAID TREASURER BY THE BUSINESS COMMITTEE.

Amount received from booth leases	$1,712 50
Amount received from check room	41 10
Amount received from smoke-stack sold	20 00
Jackson City subscription	400 00
Total	$2,173 60

MONEY RECEIVED BY BUSINESS COMMITTEE FOR BOOTH RENTALS.

1888.	No.			Tickets Issued.
Aug. 27.	1	Ladies First Baptist Church	$168 00	84
	2	Ladies Presbyterian Church	80 00	40
28.	3	D. L. Gage	52 00	26
29.	4	First M. E. Church	140 00	63
	5	G. W. Hibbard	25 00	10
31.	6	Frank B. LeClair	40 00	20
	7	Sylvester Hickman	140 00	70
Sept. 1.	8	Peter Shafer	60 00	16
	9	Moses Forah	56 00	28
3.	10	M. E. Bartlett	40 00	20
4.	10	Wm. Anderson	60 00	30
6.	11	A. Dann	9 00	4
	12	Fred L. Holton	20 00	10
	13	Mrs. Bowden and Ferguson	40 00	20
8.	14	S. A. Hickman	27 50	13
	15	Gallo	5 00	2
	16	S. K. Edwards	20 00	10

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1888.	No.			Tickets Issued.
Sept. 8.	17	F. E. Calkins & Co....	$20 00	10
	18	Perrine & Johnson....	50 00	25
	19	L. W. Lang.....	15 00	7
10.	20	N. W. Edgar.....	88 00	44
	21	F. Russo.....	15 00	7
	22	M. M. Conlon.....	12 00	6
	23	S. A. Hickman.....	30 00	15
	24	J. Dean.....	8 00	4
	25	H. Hopkins.....	15 00	7
	26	Rutzin & Wilson.....	10 00	5
	27	G. Asadonia.....	25 00	12
	28	A. C. Vermett.....	10 00	5
	30	Toofany Bros.....	20 00	10
	31	M. D. Everhart.....	16 00	8
	32	L. C. Collar.....	10 00	5
	33	Samuel S. Levy.....	10 00	5
	34	E. W. Baxter.....	15 00	7
	35	I. H. Freed.....	12 00	6
11.	36	L. Cotter.....	45 00	9
	37	W. A. Rosensweig.....	10 00	5
	38	David B. Jones.....	12 00	6
	39	Andrew Miller.....	25 00	12
	40	Jewett Williams.....	10 00	5
	41	Winsor McKay.....	10 00	5
	42	A. Tucker.....	30 00	15
	43	Toofany Bros.....	8 00	4
	44	G. A. Ferguson.....	24 00	12
	45	John Johnson.....	15 00	7
	46	John Hibner.....	20 00	10
	47	Geo. W. Holland.....	1 00	--
Sept. 11.	48	R. A. Harris.....	9 00	4
12.	49	John E. Roberts.....	6 00	3
	50	H. C. Cutler.....	6 00	3
	51	John Nelson.....	10 00	5
	52	R. E. James.....	10 00	2
	53	Mrs. Wm. Prentiss.....	6 00	2
	54	G. W. Anderson.....	6 00	3
	55	Francis Hamlock.....	10 00	5
	56	C. B. Carter.....	15 00	7
	57	I. J. Tomlinson.....	1 50	--
	58	John Hibner.....	15 00	7
	59	L. D. Sidebottom.....	6 00	3
	60	Louis Martin.....	5 00	--
	61	Elizabeth Anoram.....	5 00	2
13.	62	John Hibner.....	12 00	6
	63	O. F. Packard.....	6 00	--
14.	64	Small amounts collected.....	10 50	--
			$1,712 50	

INVENTORY OF PROPERTY BELONGING TO THE MICHIGAN STATE AGRICULTURAL SOCIETY IN THE CITY OF JACKSON.

Articles Stored in Bee House.

400 Feet field shafting and couplings.
42 Bridge trees
60 Feet shafting and bearings.
2 Iron band wheels.
1 Split band wheel.
1 Wooden band wheel.
1 Lot 1¼ inch water pipe.
1 Lot 1 inch water pipe.
1 Lot ¾ inch water pipe.
1 Lot ½ inch water pipe.
12 Lamp posts.
1 Old ladder.
1 Old plow.
4 Round water tanks.
9 Long water tanks.
2 Square water tanks.
1 Grindstone.
5 Small wooden horses.
7 Posts for fountain fence.
1 Lot stall numbers.
1 Lot 4x4 oak stakes.
2 Small rolls wire, barbed.
1 Wheelbarrow, old.
2 Pump heads.
2 Benches.
1 Hand roller.
1 Old road scraper.
1 Drag.
1 Lot pine stakes for shafting.

Stored in Main Hall.

1 Wagon and water tank.

Stored in Business Committee Room.

1 Refrigerator.
11 Ticket boxes.
14 Mattresses and 6 pillows.
2 Old bedsteads.
3 Iron garden rakes.
1 Straw fork.
1 Bush hook.
2 Wooden rakes.
3 Sash and glass.
1 Scoop shovel.
1 Post auger.
2 Pitchforks.
1 Grub hoe.
1 Pickaxe.
2 Wooden signs.
2 Water pipe keys.
1 Pair iron legs.
1 Hose cart and hose.
3 Watering pots.
1 Plantation bell.
3 Machine oil cans.
1 Whitewash brush and pail.
2 Bundles department flags.
1 Mop.
1 Piece small chain.
1 Hand saw.
1 Sledge hammer.
1 Carpenter's square.
1 Tape line.
1 Ax.
1 Branding iron.
1 Pair tackle blocks.
1 Roll rope.
3 Old oil cans.
1 Old jug.
1 Log chain.
1 Old bushel basket.
1 Pair step-ladder, new.
1 Water barrel.
1 Rubber belt.
27 Chairs.
18 Brooms.
3 Pigeon hole boxes,
1 Blackboard.
10 Tables.
1 Extension table and leaves.
1 Monkey wrench.
1 Lot pieces tar paper.
2 Pair step-ladders.
1 Tin pail.
3 Broken kegs nails.
1 Large oil can.
1 Set stencil and brushes.
1 Piece pump log.
2 Rolls chicken coop wire.
1 Socket wrench for shafting.
1 Bunch shingle.
1 Bunch lath.
6 Wooden horses.
1 Shovel.
2 Small rolls barbed wire.
2 Pair gas tongs.
1 Box of six (6) padlocks and keys.
2 Flag pulleys.
1 Flag, "Ladies."

Articles Stored in Boxes.

1 Box glass jars (unopened).
1 Box—40 faucets and 24 drinking cups.
1 Box—22 comfortables.
1 Box—8 lamps and 13 lanterns.
1 Box pipe fittings.
1 Box—30 cut-off valves.
1 Box baggage checks.
1 Box door rollers.
1 Box horticultural department plates.
10 Boxes street lamps.
1 Box decorating, including:
1 Lot cambric, red, white and blue.
1 Lot carriage shed screen.
1 Cambric canopy, red, white and blue.

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1 Large U. S. flag.
2 Small U. S. flags.
2 Streamers.
1 "State Fair" flag.
1 "President" flag.
1 "Pomological Hall" flag.
3 Boxes mosquito bar for decorating.
1 Barrel chicken cups.
1 Box banners, including:
1 Machinery.
1 Large rooster and
1 Poultry department.
1 Agricultural.
1 Fine art hall.
2 Bee and honey hall.
1 Poultry hall.
1 Fruit hall, small.
1 Fruit hall, large.
1 Exposition hall.
1 Police station.
1 Apiary.
1 Baggage checked.
1 Dairy hall.
1 Secretary's office.
1 Farm and garden produce.
1 Miscellaneous.
1 Treasurer.
1 President's room.
1 Lot "sections."
1 Lunch.
1 Manufactures.
1 Entrance.
3 Crop correspondents' headquarters.
2 Ticket office.
1 Children's department.
1 Ladies' waiting room.
1 Ladies' room.
1 Cars will take freight.

The boxes in the following list were unopened and their contents are copied from last year's inventory.

1 Box, containing two castors.
1 Box, marked "table linen," including:
8 Linen table cloths.
5 5-12 Doz. iron forks.
3 Carving knives.
1 Steel sharpener.
1 Pair scissors.
23 Tin table spoons.
1 Doz. tin tea spoons.
5½ Doz. iron knives.
1 Large iron spoon.
4½ Doz. silver teaspoons.
3 Doz. silver forks.
3 Doz. silver knives.
2 Silver sugar tongs.
3 Silver pickle forks.
6 Silver butter knives.
10 Silver tablespoons.
4 Wooden mustard spoons.
19 Wiping towels.
19 Hand towels, linen.
1 Box, marked "tinware," containing:
1 Scrub brush.
9 Wash basins.
4 Tin dippers.
2 Six (6) quart pans.
10 Tin plates.
2 Frying pans.
3 Dripping pans.
1 Cake pan.
1 Dust brush.
1 Box, marked "tinware," containing:
1 Coffee boiler.
1 Tea boiler.
1 Clothes boiler.
3 Table servers.
3 Tin pails.
1 Dish pan.
1 Tea kettle.
3 Coffee pots.
3 Tin cups.
1 Silver teapot.

Stored in Machinery Hall.

1 Line main shaft, couplings, boxes, etc.
1 Iron band wheel.
1 Wooden band wheel.

Stored in Horticultural Hall.

2 Flag poles.

Respectfully submitted,

FRANKLIN WELLS.
JOHN C. SHARP.
I. H. BUTTERFIELD.

Accepted and referred.

REPORTS OF EXECUTIVE SUPERINTENDENTS.

DIVISION A—CATTLE.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN: The exhibition of cattle at the Fair of 1888 was somewhat less in numbers than in some previous years, but in quality of exhibit of the various breeds for which prizes were offered, compared favorably with any other exhibit. I have at present no recommendations to make. I understand that there is a probability of $250 being offered for the use of this Society, as a prize for dairy cattle, by the American Shorthorn Association.

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I believe that there was general satisfaction with the awards in this department, and that the cattle growers of the State have a friendly feeling toward this Society. The exhibits and awards in this department will be found in the report of the secretary.

I. H. BUTTERFIELD,
Superintendent.

Accepted.

DIVISION B—HORSES.

To the President and Executive Committee of the Michigan State Agricultural Society:

The exhibition of horses at the State Fair of 1888 was very fine. I think, as a whole, better than ever before.

There were entered upon the secretary's books 516 horses, divided as follows:

Division B.

Class.	No. entries.	Amt. awarded.	Class.	No. entries.	Amt. awarded.
9	36	$174 00	17	27	$97 00
10	7	59 00	18	49	211 00
11	90	367 00	19	37	170 00
12	37	194 00	20	43	160 00
13	45	145 00	21	6	85 00
14	23	125 00	22	13	125 00
15	27	188 00			
16	56	227 00		516	$2,327 00

Class 9—Cleveland Bays and French Coach Horses.

At the last Fair there were a number of horses entered in this class and awarded premiums. They were the descendants of thoroughbreds and Hambletonians bred in this country about the same as the Cleveland Bays and French Coach Horses are in England and France.

A protest was entered at the close of the Fair, and withdrawn in a very gentlemanly way, showing me that a mistake had been made; and in order that it may not occur again, I recommend the following rule: That all horses to compete in Class 9 must trace to horses bred in England for Cleveland Bays, and French Coach Horses to horses bred in France. Classes 10, 11, 12, 13, 14, 15 and 16, no change. To Class 17, in my opinion, should be added males same as Classes 15 and 16. Classes 18, 19 and 21, no change. Class 22, Cleveland Bays or other stallions, strike out the words "or other" and add "French Coach Stallions."

Expense of Horse Department, $104.10.

G. W. PHILLIPS,
Superintendent.

Accepted and referred to Committee on Premium and Rules.

SPEED DEPARTMENT.

To the President and Executive Committee of the Michigan State Agricultural Society:

The Superintendent of the Speed Department would make the following report:

This department did not fill as well as was to be hoped it would, and for that reason did not turn out as well as could have been desired. The expense attending the department was $199.33; the amount of premiums paid was $1,000; the amount of entry fees received was $475.

Respectfully submitted,

W. H. COBB,
Superintendent.

Accepted.

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DIVISION D—SWINE.

To the President and Executive Committee of the Michigan State Agricultural Society:

The total number of entries in this division was 291; last year, 284. The entries in each class were as follows: Berkshire, 31; Essex, 41; Suffolk and Small York, 57; Poland China, 103; Duroc Jerseys, 11; Chester Whites and Large Yorks, 33; Fat Hogs, 9. Total amount awarded, $707, and 6 diplomas; also a special by the Berkshire Association of a silver medal.

The exhibits were above the average in quality as well as numbers, and were very creditable to the swine breeders of Michigan. Have no changes to recommend.

All of which is respectfully submitted,

JOHN LESSITER,
Superintendent.

Accepted.

DIVISION E—POULTRY.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN: The amount awarded in premiums in this division at the Fair of 1888 was $158.00. The number of entries, 379. Not as many as at some of the previous fairs, still the exhibit was creditable, and showed that in the raising of fine poultry a marked improvement is taking place in our State. Few who have not given the subject considerable attention are aware of the magnitude of this interest or of the amount of money invested in it, and the income derived from it each year. The poultry interest, in the last few years, has advanced at a wonderful rate on our farms and elsewhere. No department at our annual fairs attracts a larger number of visitors than this. At our last fair the poultry building was each day crowded from morning until night with visitors, who manifested a deep interest in the exhibition.

If new grounds are fitted up for the fair this year, I would recommend that exhibitors be required to furnish their own coops in which to exhibit their fowls; an arrangement which will be less expensive to the Society, and one which I am assured will meet the wishes of the exhibitors. Under such an arrangement the Society will only have to place shelving at the sides of the building, on which the coops could be placed.

I would also recommend that the premiums be raised at least as high as is offered by our county fairs, and that a third premium be added to each variety.

Respectfully submitted,

J. Q. A. BURRINGTON,
Superintendent.

Accepted and referred.

DIVISION F—FARM AND GARDEN PRODUCTS.

To the President and Executive Committee of the Michigan State Agricultural Society:

The exhibit in Division F, Farm and Garden Products, was a creditable one considering the dry season and the early date of holding the Fair. Total number of entries, 489, against 372 the previous year. Class 35, Grain and Seeds, 148 entries, $130.50 offered, $118.50 awarded. Class 36, Roots and Vegetables, 329 entries, $172.50 offered, $153.50 awarded. Class 37, Display of Roots and Vegetables, 3 entries, $130 offered, $65 awarded.

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There was only one display from a professional gardener. I think the prizes are too small to bring out exhibits outside of the place where the Fair is held.

Class 38, Flour, Meal and Feed, 9 entries, $39 offered, $19 awarded.

All of which is respectfully submitted,

A. F. WOOD,
Superintendent.

Accepted and referred.

DIVISION G.—DAIRY PRODUCTS.

To the President and Executive Committee of the Michigan State Agricultural Society:

As Superintendent of Division G, Dairy and other Products, I beg leave to make the following report: In class No. 39 there were 24 entries; premiums awarded, $48. Class 40, 66 entries; premiums awarded, $65. Class 41, 66 entries; no premiums. Total premiums awarded, $113; total entries, 101. The articles exhibited were of good quality, but not up to what Michigan ought to show. The Dairy Implement Department was good and attracted much attention.

I would recommend a tank or ice-box, that the butter could be in condition to show; also shelves with sliding sash and glass in front for the better protection of bread be provided.

All of which is respectfully submitted,

J. P. SHOEMAKER,
Superintendent of Dairy Products.

Accepted and referred.

DIVISION H.—BEES AND HONEY.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—I herewith submit a report of Division H, Class 42, Bees and Honey, exhibited at the Fortieth Annual Fair of the Michigan State Agricultural Society, held at Jackson, commencing September 10, 1888.

There were 60 entries in this division and $177 paid in premiums; $304 were offered. Last year was a very bad one for the bees to store honey, consequently the exhibit was much less than in former years. Notwithstanding the small exhibit, Apiary Hall had a continuous stream of interested visitors every day during the Fair, showing that there is a growing interest in this but partially developed industry. I believe that a generous support of this Society to encourage the further development of this pleasant and profitable industry will be wise and acceptable to a large class of our Michigan people.

I would further recommend a general revision of the Premium List of this department. I would recommend that premiums be offered for nuclei of the several races, or breeds of bees, instead of full colonies, and premiums be $5 for first, and $3 for second premiums, instead of $10 and $5.

I would also recommend that the premiums on extracted honey be reinstated in the list as formerly. Also, that the premium for collection of honey-producing plants be stricken from the list. I make these commendations after consulting with prominent bee-keepers of the State. One of the most attractive features of the exhibition is produced with extracted honey in jars of various forms and sizes.

M. J. GARD,
Superintendent.

Accepted and referred.

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DIVISION K—MACHINERY.

AGRICULTURAL COLLEGE, MICH., *January 14, 1889.*

To the President and Executive Committee of the Michigan State Agricultural Society:

I have the honor to submit the following report of the exhibit of the Machinery Department at the State Fair at Jackson, September 10 to 14, 1888.

Report of Superintendent.

Machinery Hall at Jackson, in which most of the entries were exhibited, is a building 50 by 150 feet. The roof is supported by posts which stand in such a way as to give us five aisles lengthwise of the building, and thirteen aisles crosswise. The space free of posts in any particular place was 10 by 11½ feet. The main driving shaft for machinery was 2 7-16 inches in diameter, and located in the center of the building lengthwise. It was a matter of some difficulty to arrange machinery exhibits in such a building to the best advantage, and impossible to satisfy the demands of all exhibitors. I finally decided that the exhibits could best be shown if in the south part of the building the center space and side space were reserved for exhibits, with two aisles for spectators, and in the north part of the building, the whole space to be given to exhibits, with the exception of one aisle. The Chairman of the Business Committee very kindly had the building divided in this way. This was quite satisfactory to exhibitors, and would have been perfectly so had there been a second line of shafting on the west side of the building over Division H.

The arrangement of the building is shown in the accompanying blue print.

The following exhibits were shown in the building: Division A, sections 1 and 2, E. Dennis & Co. showed a collection of power planers, buzz saws and band saws. Sections 3 and 4, Geo. Wolcott, Jackson, showed several power shapers for working metal, and one lathe in operation. Division B was entirely occupied by the exhibit from the mechanical departments of the Agricultural College. The work shown was manufactured entirely by the students, and consisted of three lathes for working in wood, shown in operation in section 1. About 75 machine drawings and 100 more of specimens of turning in wood were shown in division 2. One 15-inch engine lathe, one 15-inch turret lathe, one 12-inch engine lathe, one pair of 12-inch surface plates, and about 150 specimens of blacksmith-shop work were shown in sections 3 and 4. One 25-horse automatic power engine, one 4-horse power double engine and three 3-horse power engines were shown in operation in sections 5 and 6.

In Division C, section 3, Dennis & Glover, of Saline, Mich., exhibited an emery grinding machine and a Waid engine model. In section 4 Rodebaugh, Garrison & Co., of Jackson, exhibited several varieties of saw-mill dogs, saw guides and self-oilers, also an interesting model of the first power log turner. Space 5, mill machinery by John Hutchinson Co. Space 2, F.W. Olds, of Munich, Mich., made an exhibit of saw frames. In Division E, sections 1, 2, 3 and 4 were occupied by the Smith Purifier Co., of Jackson, who made a very instructive and complete exhibit of modern mill machinery. Space 6 was occupied by Wm. Herring, of Allen, Mich., with an exhibition of apple-reducing machinery. The whole of Division D, two sections in Division A, and one section in Division C, were occupied by agricultural implements, under the supervision of Mr. Young, of Paw Paw.

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There was some machinery entered in Division K, exhibited elsewhere on the grounds. Dennis & Glover exhibited one 2-horse power engine; Lansing Iron and Engine Works, one pocket mill; Whitely Bros., Lansing, one saw-mill; J. C. Haag & Sons, Lansing, one Little Giant picket-fence machine.

Character of the Exhibit.

The exhibit was far from being satisfactory, according to my standard, and would have been very poor had it not been for the College exhibit. With the permission of the Chairman of the Business Committee I issued a circular, which I mailed to all the prominent manufacturers and dealers in machinery in the State. A copy of this circular is submitted with the report. I had quite a number of inquiries and a few promises to exhibit as a result of the circular. I also wrote several personal letters, and called on a number of people with very little success. A few who promised to exhibit did not arrive. I was very much disappointed at the late arrival of some fine exhibits; machinery that should have been in place Monday was not even entered until Tuesday afternoon; this made it necessary to rearrange to some extent the exhibit already in the building, and effectually prevented any classification whatever. That is an evil that will be especially difficult to remedy in the machinery department, because the advertising value of the exhibit is all the inducement we offer, and this inducement to the manufacturer of general machinery is not a weighty one.

The manufacturers of agricultural implements, on the other hand, are fully educated to the value of exhibiting at the State Fair, and add a great deal to the attractiveness of the Fair. A fine exhibit of general machinery would be even more attractive; it would be of great educational value to the mechanic and to our young men, and is certainly worth making some effort to secure. One of the principal reasons urged against showing at the Fair by manufacturers, is, aside from the expense, the fact that they receive no notice whatever, and the spectators have little or no appreciation of good work and good machinery. The point is also made that usually there is no competition, and consequently little or no interest is taken in the exhibit. While I do not believe this last is true, still I have no doubt if we could awaken a spirit of competition in this line, the exhibit would be much improved.

I have thus briefly set before you, what no doubt you have all realized in regard to this particular department. My experience is not sufficient to warrant me in recommending any special change in the method of conducting it. I do not believe that premiums could be awarded with any justness, neither do I believe they would be of especial inducement to exhibitors. I have, however, thought that the award of a diploma signed by a viewing committee, to every exhibitor who has a meritorious exhibit and who complies with the rule as to time of entries, and in other ways, would be valued as a memento and would serve as an incentive to make an exhibit. If such a diploma was properly worded, no possible responsibility regarding the merits of the machinery shown could be attached to the Society. I would ask your consideration of the above suggestion.

I am respectfully yours,

R. C. CARPENTER.

Accepted and referred.

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DIVISION L—MANUFACTURED GOODS.

To the President and Executive Committee of the Michigan State Agricultural Society:

The undersigned, Superintendent of Exposition Hall, containing five divisions, viz., Fine Arts, Music, Needle Work, Children's Department, and General Manufactures, respectfully makes the following report:

The hall had been considerably improved in the floors and roof, and was in fair condition. The building is old and will need extensive repairs before it will be safe to occupy for another Fair. The exhibitors were generally disposed to make the best of the situation, and there was no claim for damage to, or loss of goods.

The exhibition in this hall in the various departments was very large, and generally very full in their line. Some of the departments were somewhat crowded, but all were well and tastefully arranged and displayed. The exhibitors were generally well satisfied with position, space, attention and awards.

As Superintendent of Division L, Manufactured Goods, I respectfully report as follows, viz.:

The regular exhibition in most of this department was very full and good, and of non-enumerated articles very large and attractive, and many of great practical utility. This division includes six classes, Nos. 52 to 57 inclusive. Whole number of entries, 102; whole amount of premiums offered, $436; whole amount awarded, $151; regular premiums, $144; discretionary, $7; amount offered more than awarded, $285.

Class 52. Materials.

There was but one entry and one exhibit in this class, and that was of flax, which was of a very good quality and nicely dressed. Amount of premiums offered in this class, $70; amount awarded, $3. The amount of premiums offered in this class, *on wool*, in 1887, was $45; in 1888, $40. There were in 1887, 13 entries and exhibits of wool. Some of the samples shown were of a very superior quality of their different grades. The whole exhibit of wool in 1887 was creditable. Amount of premiums awarded was, regular, $42; discretionary, $7, on a very fine collection. The same amount of premium on wool was offered for 1888, but there were no entries nor exhibits of wool, and of course no awards. In a State that produces as much and as good wool as Michigan, there must be some good reason why there are no exhibitions of wool. I trust the Premium List Committee will be able in their List to be made at this meeting to offer such inducements as will result in a large and creditable exhibition of wool at our next annual Fair.

Class 53. Factory-Made Goods.

In this class there were no premiums offered nor awarded. There were four entries and exhibits, but were of indifferent quality and of no special merit.

Class 54. Articles of Dress.

In this class there were no premiums offered nor awarded. There were four entries and a very large exhibit, and a very attractive display, for which the exhibitors are entitled to credit, as it was quite an addition to the attractions of the Hall.

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Class 55. Articles of Leather, and India Rubber Goods.

The exhibit in this class was large and mostly of good quality of their kind. The display of boots and shoes especially was very fine. Number of entries, 28; premiums offered, $114; awarded, regular, $24; discretionary, $1; in all $25.

Class 56. Articles of Furniture.

In this class the exhibit was large and very good. Number of entries, 34; premiums offered, $217; awarded, regular, $117; discretionary, $3; in all $120. There was quite a number of non-enumerated articles exhibited in this class that were of fair quality but of no special merit.

Class 57. Stoves, Iron Work and Ornamental Concrete Work.

In this class the number of entries was 35; premiums offered, $35; awarded, $3. While the amount of premiums offered in this class is not large, it is still one of the most important and useful classes in the whole division of manufactured goods, and the privilege of exhibiting their goods at our annual Fairs to possible purchasers is sufficient inducement to make the exhibition large and interesting. The display of all kinds of stoves, ranges, furnaces, floor tile, mantels, grates, door trimmings and many other articles of that class was very large and good, and attracted much attention. As it is well known, the manufacture of stoves and ranges of all kinds and varieties is a large and important industry, carried on in Detroit and elsewhere in the State, it was expected to find the goods in large variety and of first quality on exhibition, and the patrons and visitors at the Fair were not disappointed. The course adopted some years ago by this Society to offer no premiums on stoves, has resulted in no lack of exhibits or loss of interest in the annual exhibitions of this Society.

There is annually exhibited at our Fairs a large class of articles of manufactured goods on which there is no premium offered, nor expected by the exhibitor, but quite a large share of them are valuable products, not only to the manufacturers, but of great utility to the consumers, the manufacturers being satisfied with space and opportunity to exhibit their goods, relying on their merit for their chance of remuneration, and I recommend that a liberal policy be pursued by this Society for their exhibition by providing ample and proper room and other reasonable facilities to such exhibitors in this department.

All of which is respectfully submitted,

HENRY FRALICK,
Superintendent.

Accepted and referred.

The report of the Superintendent Cobb on Police was read by the Secretary as follows:

To the President and Executive Committee of the Michigan State Agricultural Society:

The Superintendent of Police would report that the number of police employed for all purposes was 41; the amount paid the same was $349.50. This includes the men used in the halls and on the track, as well as all around the outside of the grounds. There were three persons arrested and taken out of the grounds (all boys) for climbing over the fence. But one person was seen intoxicated on the grounds, and he was in

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that condition when he came there, but he left after being requested to do so. General good order prevailed during the Fair.

Respectfully submitted,

W. H. COBB,
Superintendent of Police.

Accepted.

The report of Chairman Cobb on Transportation was read as follows:

To the President and Executive Committee of the Michigan State Agricultural Society:

The Superintendent of Transportation would report that as far as has come to his notice, everything has been very satisfactory both to exhibitors and the Society. The Michigan Central R. R. Co. were very obliging, and in fact did all in their power to make the Fair a success, and all the railroad companies carried out the arrangements as per agreement made before the Fair commenced, and your Superintendent thinks they are entitled to a vote of thanks from this Society.

The expense attending this department was less than two dollars.

Respectfully submitted,

W. H. COBB,
Chairman.

Accepted.

Upon motion, adjourned until Tuesday morning at 9 o'clock.

SECOND DAY.

THE WAYNE, DETROIT, *January 15, 1889.*

The Executive Committee resumed its session this morning pursuant to adjournment, the President, A. O. Hyde, in the chair.

Roll called. Present: President Hyde, Messrs. Hanford, Lessiter, Sharp, Fifield, Reed, Smith, Burrington, Wood, Shoemaker, J. P., Gard, Young, Butterfield, Watkins, Anderson, Wells, Phillips, Fralick, Parsons and the Secretary.

The reports for Divisions M, O, and Q were presented by Superintendent Anderson, as follows:

DIVISION M—MUSICAL INSTRUMENTS, ETC.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—I submit herewith report of divisions under my charge, as follows:

Division M—Musical Instruments, etc.

Classes No. 58, 59 and 60, number of entries 43; awards, $3.00.

Division O—Needle Work.

Class 63, number of entries 7; awards, $13.50. Class, 64, number of entries 50; awards, $27.50. Class 65, number of entries 156; awards, $95.50. Class 66, number of entries 103; awards, $39.00. Class 67, number of entries 25; awards, $21.50. Total, $197.50.

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Division Q—Children's Department.

Number of entries, 67; awarded, $29.50.

I was not present during the exhibition until the last day, when I found all departments full and complete. Mr. Henry Fralick kindly consented to care for my department, for which I desire to express my sincere thanks.

The Children's Needle and Fancy department I placed under the care of Miss Minnie Brow, who, as in the past, cared for it very efficiently.

At the suggestion of Miss Brow, who is so familiar with this particular department, I have recommended a revision of Divisions O and Q, and trust it may be favorably considered by the premium list. In making this revision we decrease the amount of awards offered $32.50, and make it to conform with the latest works of Needle Art, which changes under the skillful manipulation of the needle.

Respectfully submitted,

M. P. ANDERSON,
Superintendent.

Accepted and referred.

DIVISION J—VEHICLES.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—The superintendent of Division J, Vehicles, would report: There were 229 entries, the entire space allotted being full, and a much larger exhibit would have been at the Fair had there been room for the display of goods. The exhibit was mainly of Michigan manufacture, and attracted much attention from visitors.

Respectfully submitted,

F. L. REED,
Superintendent.

Accepted.

DIVISION R—HORTICULTURE.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—The undersigned, superintendent of Division R, Fruit and Flowers, would beg leave to report: That the whole number of entries in this division was 329, viz.: Class 1, no entries; Class 2, 6; Class 3, no entries; Class 4, 3; Class 5, 5; Class 6, 11; Class 7, 22; Class 8, 3; Class 9, 18; Class 10, 192; Class 11, 24; Class 12, 5; Class 13, 6; Class 14, 15; Class 15, 20. Premiums offered, $951.50; paid, $392.50.

This report may seem discouraging for the future of this department; but the exhibition would have been as full and select as ever made in the State had it not been for the unparalleled drought, lateness of the season and early date of the Fair, making a full month's difference in the maturity of fruit from that usually shown at the State Fair.

It is significant that there was not a plate of ripe fruit shown, except of the earliest varieties. Fruit-growers nearly all reported that their fruit was so late and unripe as to be totally unfit for exhibition.

I would recommend a revision in all classes of Division R. The list as used in 1888 was a copy of that made by the State Horticultural Society, which, though it may

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have met and filled the wants of that Society, is not such as will bring out the best exhibit for our Society.

L. D. WATKINS,
Superintendent.

Accepted and referred.

Mr. Fralick offered the following resolution:

Resolved, That President Hyde be appointed President *pro tem.*, with full power to act during the absence of President Palmer, and that we proceed with our business in the usual manner, with the exception of the appointment of the Standing Committees, except the Committees on Premium List, Rules, and Finances, and Executive Superintendents.

Upon motion Rule II. was suspended, and the resolution adopted.

Upon motion of Mr. Phillips it was resolved that competition be open to the world, excepting in special cases named in the premium list of 1888.

The Secretary then read the following communications, which were accepted and referred to the Committee on Premiums:

From W. M. Hilbert, asking that a special class be made for Yorkshire swine.

From President Wyckoff, of the Michigan Galloway Breeders' Association, asking that Galloway Cattle be given a class separate from Angus.

From W. L. Morse, suggesting a classification of Sheep, and asking that the entries be open to the world.

A communication was then read from Mr. George F. Lewis, Secretary of the N. E. Agricultural Society, asking the Society to appoint a Committee on Transportation to confer with a like committee of the district society.

The committee appointed to prepare resolutions upon the death of ex-President Baxter, reported as follows:

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—Your Special Committee appointed to prepare suitable resolutions relative to the death of Hon. Witter J. Baxter, one of our oldest and most efficient Presidents and members of the Executive Committee of this Society, respectfully recommend the adoption of the following preamble and resolutions:

WHEREAS, Since our last annual meeting, death has removed from his sphere of usefulness the Hon. Witter J. Baxter, one of the oldest members of this Society, a generous and well-loved friend, and one of the earliest and ablest officers and promoters of the success of this Society; therefore,

Resolved, That in the death of our friend, the Hon. Witter J. Baxter, we mourn the loss of one of the earliest and most efficient officers and members of this Committee and Society, who in its early days was always a wise counselor, a capable and successful worker, either in council or the field. The best interests of the Society was always his aim and object, and in times of trial or difficulty to the Society, his ability and integrity of purpose was always a beacon of light to its officers and members. His long life of honorable and invaluable public services to the State, in many important trusts, justly gave him great influence in matters pertaining to the true interests of this Society, and we count his loss, as a wise adviser and co-worker, almost irreparable. In his private life he was a much loved and respected friend and citizen, whose pleasant face and kindly greeting, at our annual meetings and Fairs, we shall greatly miss, and

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whose vacant place, for many of us who have been his associates for many years in this and other useful societies, can never be filled. A good man has gone to his rest.

Resolved, That we will ever gratefully cherish sentiments of profound respect and affection for his memory. And that we extend to the bereaved family our sincere sympathy, in their loss, and assure them that, as the beloved relatives of one whom we all loved, they will ever have our affectionate remembrance.

Resolved, That the Secretary be instructed to communicate these expressions of our regard to the family of the deceased.

Respectfully submitted,

HENRY FRALICK.
G. W. PHILLIPS.
I. H. BUTTERFIELD.

Feeling and appropriate remarks touching upon the life of Mr. Baxter were made by Mr. Parsons. The resolution was adopted by a rising vote.

An invitation was presented by Mr. Whitney inviting the Committee to attend the theater this evening. Accepted with thanks.

The President announced the following committees:

Premium Committee—Messrs. Phillips, Butterfield, Sharp, Young, Lessiter, Gard and Wood.

Committee on Rules—Messrs. Hanford, Fifield and Burrington.

Committee on Finance—Messrs. Anderson, Shoemaker and Reed.

Mr. Sharp moved that a special Committee on Horticultural Premiums be appointed.

The motion prevailed, and the President announced as such committee: Messrs. Watkins, Smith and Kelsey.

The Committee then took a recess until 2 o'clock.

AFTERNOON SESSION.

The Executive Committee resumed its session at 2 o'clock P. M.

The Committee appointed at the September meeting to present resolutions upon the death of Mr. Sherwood, reported as follows:

Since the last regular meeting of this Committee, we are pained to learn of the death of the Hon. Harvey C. Sherwood, of Watervliet, Berrien county.

Mr Sherwood was President of the West Michigan Agricultural Society at the time of his death, and was well known in the State as a gentleman interested in agricultural pursuits; and through his instrumentality its material interests were advanced. We desire, in this report, to express our respect for him as a Christian gentleman and worthy citizen, whose loss we deeply regret.

Resolved, That this memorial be placed in the records of this Society, and a copy of the same be forwarded to his family.

WM. CHAMBERLAIN.
FRANKLIN WELLS,
C. W. YOUNG,
Committee.

Adopted by a rising vote.

The report on Farm Implements was presented by Supt. Young, as follows:

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To the President and Executive Committee of the Michigan State Agricultural Society:

In Division I, Farm Implements, there was a fine exhibit, although the number of entries was not so great as in 1887.

The arrangement of the several lines of goods was in some instances interfered with, for the reason that space needs to be newly assigned *each* year to *all* the several exhibitors, whereas, if the Fair were permanently located, the larger and better class of manufacturers would take pride in putting up suitable and substantial buildings, in which to not only show their several lines, but where they could put them in shape to show, at their leisure, before the week of the Fair.

In view of the fact that one of the most—if not *the* most—attractive department in the whole Fair does not cost our Society one cent in premiums, and but a small item by way of power furnished, and also that nearly all of the exhibitors have repeatedly asked that some permanent location be selected where they can erect suitable buildings in which to display their goods, we will say that, in our judgment, the time has fully come when, for the best interest of the farm implement manufacturers, the State Fair should be permanently located.

C. W. YOUNG,
Superintendent.

Accepted.

General Superintendent Chamberlain reported verbally.

Mr. Chamberlain was requested to reduce his report to writing, including mention of the Georgia exhibit.

Upon motion of Mr. Sharp, it was

Resolved, That the Business Committee provide for a President's lunch room during the next Fair, according to the old-time custom.

A recess until 7 P. M. was then voted.

EVENING SESSION.

The Committee resumed business at 7 o'clock, President *pro tem.* Hyde presiding.

General Superintendent Chamberlain presented his report, as follows:

The exhibits in every department of the Fair were excellent, and arranged in a convenient and attractive manner by the exhibitor. Abundant space was provided for all, and the best of feeling prevailed. Everything was in order by Tuesday, when visitors began to appear upon the grounds. The weather was all that could be desired.

The side-shows and attractions of this character which are usually numerous at such times, were noticeably wanting on the grounds last year. So far as an educational feature, they were no loss to the public; but as a source of revenue to the Society there was a falling off from preceding years from this source.

The Society and visitors were greatly pleased with the exhibit of the products from the State of Georgia, made by Major Glessner of that State. The display of cotton in its various stages of growth, together with different varieties of grasses, grains, fruits and minerals of that State, was a feature of the Fair which was new and highly appreciated by all.

I recommend that arrangements be made at future Fairs for the accommodation of State exhibits from other States, and that similar displays as made by Major Glessner be encouraged by this Society.

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I also recommend that the Society provide for the better entertainment of the guests of the President during the Fair.

I am of the opinion that the Society would be greatly benefited by providing for opening the grounds in the evening and furnishing some attractions that the public would be interested in attending. I believe that this would become popular, and profitable to the Society.

WM. CHAMBERLAIN,
General Superintendent.

The report was accepted and adopted, and a vote of thanks tendered Major Glessner for his courteous manner in explaining the exhibit to visitors at the Fair.

Upon motion, the Committee took a recess until 8 o'clock Wednesday morning.

THIRD DAY.

THE WAYNE, DETROIT, }
January 16, 1889. }

The Executive Committee resumed its session at 8 o'clock A. M., President *pro tem.*, in the chair.

Present: President Hyde, Treasurer Dean, Messrs. Hanford, Lessiter, Sharp, Kelsey, Fifield, Reed, Smith, Burrington, Wood, Shoemaker, J. P., Gard, Howard, Young, Butterfield, Watkins, Anderson, Wells, Phillips, Fralick, Chamberlain and the Secretary.

A delegation from Jackson was present and was invited by the President to address the committee. Messrs. J. C. Richardson, D. S. Smith and W. J. G. Dean accepted the invitation, and invited the Society to hold its annual Fair at Jackson. The gentlemen stated that the people of the Central City were anxious to have the Fair, and would subscribe liberally for it.

Upon motion of Mr. Dean it was

Resolved, That the Society is desirous of receiving propositions for either a permanent or temporary location. Proposals may be addressed to the Secretary until March 1.

Mr. Sharp offered the following, which was adopted:

Resolved, That President Palmer be authorized to appoint, after adjournment, the Executive Superintendents and the balance of the Standing Committee, and he is requested to name the Business and Transportation Committees at his earliest convenience.

Be it further resolved, That the President appoint a permanent Locating Committee, to consist of seven members, of which he shall be chairman.

Treasurer Dean submitted his annual report, as follows:

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TREASURER'S REPORT.

FAIR HELD AT JACKSON, 1888.

Cash on hand at settlement	$3,839 06
RECEIPTS DURING THE YEAR.	
Jackson Subscription	400 00
Gate Receipts	12,595 95
Membership Certificates	708 00
Secretary, for Stall Rents	407 75
" " Speed Entries	475 00
" " Sales Department	35 45
" from Mr. Turner	10 00
Wm. Ball	5 00
L. D. Watkins	19 00
Business Committee:	
Booth Rent	1,712 00
Check Room	41 10
Sale of Property	20 00
	$20,268 81

DISBURSEMENTS.	
Business Orders	$8,785 51
Premium Checks, 1887	14 00
" " 1888	10,610 00
L. D. Watkins	4 33
Balance on hand	854 97
	$20,268 81

A. J. DEAN,
Treasurer.

Accepted and referred.

The report on Sheep was presented by Superintendent Howard, as follows:

DIVISION C—SHEEP.

To the President and Executive Committee of the Michigan State Agricultural Society:

The exhibition of Sheep at the last State Fair was unusually good, both in numbers and quality. The number of entries and awards in each class, as shown by the books of the Secretary, was as follows:

Classes.	No. Entries.	Amt. Awarded.	Classes.	No. Entries.	Amt. Awarded.
23	79	$247 00	29	48	$153 00
24	83	176 00	30	31	123 00
25	22	45 00	31	24	122 00
26	15	102 00	32	23	93 00
27	124	152 00		470	$1,317 00
28	21	107 00			

D. W. HOWARD,
Superintendent.

Accepted.

The Committee on Horticultural Premium List presented the report, striking out Class 5; third and fourth premium in all classes; increasing first and second premiums in Classes 1 and 7, and adding several varieties of fruits in Class 10.

Accepted and adopted.

Recess until 2 o'clock P. M. voted.

AFTERNOON SESSION.

The Committees resumed business at 2 o'clock P. M.

The following communication was read:

MR. PRESIDENT AND GENTLEMEN: I appreciate the hand of fellowship extended to me, not being a member of your Society, or a delegate to the meeting. I am also pleased to have had the pleasure of meeting you all and becoming acquainted To show the interest of myself and partner, Mr. Lovell, who are members of the M. & M. A. of Jackson, in this Association, we extend to you, in the name of the M. & M. A. of

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Jackson, an invitation to hold your next meeting at the Hibbard, as their guests, showing you, gentlemen, we are willing to bear some of the expenses of this Society, no matter where the Fair may be held. The best interest of your Society will be our interests.

Respectfully,

JOHNSON & LOVELL.

Received, and a vote of thanks extended to the M. & M. Association.

Upon motion of Mr. Fralick, it was

Resolved, That ex-President Hyde, the Treasurer, Secretary, and Present Business and Transportation Committees be appointed a Special Committee to correspond with President Palmer, and to meet him at his earliest convenience in consultation, with full power to take such action as in their judgment will be for the best interest of this Society.

Upon motion of Mr. Wells, the thanks of the committee were tendered Mr. Will H. Gilbert, for services rendered as clerk of the Business Committee.

Mr. Anderson offered the following:

Resolved, That the thanks of the Executive Committee be tendered to Mr. C. J. Whitney for his courtesy extended to and accepted by this Committee, and for their very pleasant and enjoyable entertainment.

Adopted by a unanimous vote.

Mr. Wood moved, and it was supported, that the annual Fair be held the last week in September.

Mr. Dean moved as an amendment, that the Fair be held the week commencing September 16.

On motion tabled.

Mr. Butterfield offered the following, which was adopted:

WHEREAS, The State Board of Agriculture have put in their estimates for the use of the Agricultural College to be placed before the Legislature the sum of $8,000, for the purpose of erecting a suitable building for the use of the Agricultural Department of the College. Therefore,

Resolved, That this Board respectfully request of the present Legislature the appropriation of the said sum for that purpose mentioned.

A recess until 7 P. M. was then voted.

EVENING SESSION.

The Committee resumed its session at 7 o'clock.

Upon motion it was

Resolved, That the thanks of this Society be tendered to the Business Committee for the able, economical and courteous manner in which they have performed the arduous duties which devolved upon that committee during the last year.

The Finance Committee made their report, as follows:

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To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—We, the undersigned Committee on Finance, beg leave to report that we have made a careful examination of the books and accounts of the Secretary and Treasurer referred to us as follows:

Cash on hand at settlement, January, 1888	$3,839 06	
Cash received during the year from all sources	16,429 75	
Total receipts		$20,268 81
Disbursements	$19,413 84	
Balance on hand	854 97	
Total		$20,268 81

We find this statement agrees with their reports. We also find outstanding orders (premium checks) unpaid to the amount of $106, which, when paid, will leave the balance on hand available to be $748.97. We recommend that the bond of the Treasurer be reduced from $30,000 to $10,000. We further report that the Secretary's bond has been received and affirmed.

All of which is respectfully submitted,

W. P. ANDERSON,
J. P. SHOEMAKER,
F. L. REED,
Finance Committee.

Accepted and adopted.

The Committee on Rules reported as follows:

Your Committee to whom was referred the revision of the rules that govern the action of this Society beg leave to report that we have carefully examined them and recommend but few changes.

H. O. HANFORD,
EUGENE FIFIELD,
J. Q. A. BURRINGTON.

Accepted and adopted.

The principal changes were to Section 1, Article 9, which was amended to read "Competition in all Departments open to the World," unless specially exeepted.

In Division B, horses in Class 9 are required to be registered in the Cleveland Bay Stud Book of America or the French Coach Horse Stud Book of America.

In Division C, Southdown Record stricken out; The Ohio Merino Register added, and exhibitors allowed fifteen entries instead of fifteen animals.

In Division D, fifteen entries in place of fifteen animals allowed, and Swine in the Essex class required to be registered or be eligible to registry in the Essex Record.

In Division E, exhibitors required to furnish coops.

Report accepted and adopted.

Mr. Sharp offered the following resolutions:

Resolved, That this Committee recommend the enactment by the present Legislature of a law providing for the inspection alive and on foot, at the place of slaughter within the State, of all neat cattle intended for consumption as human food, within the cities and villages in Michigan.

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Resolved, That this Committee also recommend the enactment of a law requiring the managers of our State institutions to purchase the meat supply therefor from the product of animals fatted and slaughtered in Michigan.

The first was adopted by the following vote:

Yeas—Messrs. Hanford, Lessiter, Kelsey, Sharp, Reed, Burrington, Wood, Shoemaker, J. P., Gard, Young, Butterfield, Anderson, Wells, Phillips, and Fralick—15.

Nays—Messrs. Fifield, Smith, Howard, Watkins, and Chamberlain—5.

The second resolution was then adopted by the following vote:

Yeas—Messrs. Hanford, Lessiter, Kelsey, Sharp. Reed, Smith, Burrington, Wood, Shoemaker, J. P., Gard, Young, Butterfield, Anderson, Phillips, and Fralick—15.

Nays—Messrs. Fifield, Howard, Watkins, Wells, and Chamberlain—5.

The Secretary was instructed to send a copy of the resolutions to the Legislature.

Upon motion the question of dates of Fair, tabled at the afternoon session, was taken up, and the dates for the Fair of 1869 fixed as September 16, 17, 18, 19 and 20.

Upon motion the Secretary was requested to notify the Secretaries of the Western Michigan and Northeastern Michigan Agricultural Societies of the dates chosen.

Upon motion of Mr Butterfield, it was

Resolved, That the thanks of this Board are due and are hereby tendered to the proprietor of "The Wayne" for the satisfactory manner in which the Board has been entertained during this meeting.

The Premium Committee offered their report, as follows:

Your Committee on Premium List have with great care revised the list, cutting off apparently unnecessary premiums so far as possible, and reducing the same so far as in their judgment is practicable.

GEO. W. PHILLIPS,
I. H. BUTTERFIELD,
C. W. YOUNG,
JOHN LESSITER,
JOHN C. SHARP,
M. J. GARD,
A. F. WOOD.

It was voted to take the report up by divisions.

Mr. Fralick moved to strike out all third premiums.

Lost.

Division A adopted, with Herd and Sweepstakes Premium of Classes 2 and 5 stricken out.

The following resolution was then adopted:

WHEREAS, This Board has learned semi-officially that the American Shorthorn Breeders' Association propose to place at the disposal of this Society a sum of money for a prize for Shorthorns for the dairy; therefore

Resolved, That in case this offer is made by the Shorthorn Association, it be accepted by this Board, and the same be arranged and placed in the Premium List of this year by the Secretary and Superintendent of Cattle in accordance with terms offered.

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Division B adopted with following changes from List of 1888: In Class 11, Geldings, five years old, stricken out. Classes 19 and 21 stricken out. Slight change in premiums in Classes 12, 17 and 20.

Speed department: For Stake Races for Colts to be trotted under the rules of the Michigan Horse Breeders' Association, one for two-year-old colts; one for three-year-old colts; one for four-year-old colts, with $5.00 to accompany nomination to be made March 15, 1889; second payment of $5.00 to be made May 1, with the final payment of $10.00 to be paid September 2, 1889; and that the Society add one hundred dollars to each stake. Open to Michigan only.

We recommend that a sum not to exceed $2,000 be offered for speed at the next Fair, the arrangement and division to be made by a special committee, to consist of A. J. Dean, C. W. Young, and Eugene Fifield, the races to be under the direction of the Superintendent of Horses.

Adopted.

Division C adopted with the following changes: Classes 24, 26 and 28 stricken out; Class 30 to read "Cotswolds and Lincolns;" premiums in Class 30 made same as in Class 23; premium in Class 32 reduced to $8.00, $5.00, and $3.00.

Division D adopted; no changes.

Division E adopted; five new varieties added.

Division F adopted; with only three changes in amount of premiums.

Division G adopted; no change.

Division H adopted; list revised and $18 added.

Divisions I, J and K adopted; no changes.

Division L adopted with slight change.

Divisions M and N adopted; no changes.

Division O adopted; revised list.

Division P adopted; no change.

Division Q adopted; revised list.

Mr. Fralick moved that the action of the committee in adopting third premiums be reconsidered.

Lost.

Mr. Chamberlain moved to reconsider the vote adopting the report excluding Class 28.

Lost by the following vote:

Yeas—Messrs. Howard, Wells, Chamberlain, Hyde—4.

Nays—Messrs. Hanford, Lessiter, Kelsey, Sharp, Fifield, Reed, Smith, Burrington, Wood, Shoemaker, J. P., Gard, Young, Butterfield, Watkins, Anderson, Phillips, Fralick and Dean—18.

The report of the Premium Committee was, on motion, adopted as a whole.

Upon motion, a recess until 8 o'clock Thursday morning voted.

FOURTH DAY.

THE WAYNE,
Detroit, January 17, 1889.

The Executive Committee resumed its session this morning at 8 o'clock. President *pro tem.* in the chair.

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Present: Chairman Hyde, Treasurer Dean, Messrs. Hanford, Lessiter, Kelsey, Sharp, Fifield, Reed, Smith, Burrington, Wood, Turner, Shoemaker, J. P., Gard, Howard, Butterfield, Watkins, Anderson, Wells, Phillips, Chamberlain, and Secretary.

Mr. Sharp offered the following, which was adopted:

WHEREAS, Large appropriations have been made by former legislatures of this State to provide ample accommodations for the Chemical, Botanical, Entomological, Veterinary, Mechanical and Horticultural departments of the Michigan Agricultural College, aggregating many thousands of dollars for each of these departments, while the Agricultural Department, according to the Governor's recent message, has been allowed only the meagre sum of $400 for this purpose; and

WHEREAS, We believe that the Agricultural Department, which at an Agricultural College, in the very nature of things, should be kept fully abreast of all others in its equipment for work, that it may stand on an equal plane with them; and,

WHEREAS, The State Board of Agriculture has placed in their bill of estimates, to present to the State Legislature now in session, the sum of $8,000 for an Agricultural laboratory and equipment, which action has been indorsed by the State Grange at its recent session, by the Michigan Sheep Breeders' Association, the Holstein, Shorthorn and Galloway Cattle Breeders' Associations at their recent annual meetings; and,

WHEREAS, We believe that this appropriation will greatly contribute to the efficiency of the Agricultural Department and is in accord with the advanced public sentiment of the leading agricultural organizations in this State; therefore be it

Resolved, That, as the Executive Committee of the State Agricultural Society, we hereby cordially indorse the action of the Board of Agriculture in asking for this appropriation, and we hereby most respectfully petition the Honorable, the Legislature of Michigan, now in session, to make such appropriation, feeling assured that the best interests of the College and of the State will be served by such action. And your petitioners will ever pray.

Resolved, That the Secretary of this Committee forward a copy of this preamble and resolutions to the President of the Senate and the Speaker of the House of Representatives at Lansing, with the request that they be printed in the Legislative Journal, and referred to the proper committee.

Mr. Fifield moved to reconsider so much of the report of the Premium Committee as refers to striking out Hampshire sheep.

The motion prevailed.

The same gentleman then moved that Hampshire sheep be placed back in the list, with the same premiums as last year.

Carried.

A resolution of thanks was voted the Michigan Central and the Detroit, Lansing & Northern railroad companies for courtesies extended.

The following resolution was adopted:

Resolved, That this Society shall join with all other agricultural societies in this State in requesting of the Legislature an appropriation annually to aid the various agricultural societies to an amount equal to twenty per cent of the premium lists paid by the several societies, and that the secretary of this Society be and is hereby directed to notify the presidents and secretaries of each agricultural society in this State of this movement.

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Resolved further, That a committee of five, consisting of Messrs. Turner, Chamberlain, Ball, Wells and Watkins, be and is hereby appointed to formulate and urge such legislation, and that the secretary be and is hereby directed to arrange for the circulation and signing of proper petitions, by obtaining the aid of the officers of each agricultural society in the State and otherwise.

Ad ourned *sine die*.

A. O. HYDE,
President.

J. C. STERLING,
Secretary.

MEETING OF LOCATING COMMITTEE.

DETROIT, *April 3, 1889.*

In pursuance of a resolution passed at the annual meeting of the Executive Committee,

President Palmer, Treasurer Dean, Messrs. Wells, Sharp and Butterfield (Business Committee), Turner and Fifield, of the Transportation Committee, and the Secretary, met in the parlors of the Wayne at 2 o'clock P. M.

President Palmer in the chair.

Messrs. Ball, Phillips and Lessiter, members of the Executive Committee, were also present.

Mr. J. E. Warner, President of the Central Michigan Agricultural Society, invited the State Society to locate the Fair permanently on the grounds of the Central Society, and offered to present the fair grounds and buildings of the Central Society to the State Society. Mayor Turner, J. J. Baird, Secretary of the Central Society, and several citizens of Lansing present urged that the Fair be located permanently at the Capital City.

Mr. Turner moved that the Executive Committee be called together at the Wayne on Wednesday, April 24, to consider the question of permanent location.

Mr. Sharp stated that the Executive Committee had power to locate permanently at a regular annual meeting only.

Mr. Turner then withdrew his motion.

President Palmer appointed the following named gentlemen a Committee on Permanent Location (the President a member by resolution of the Executive Committee): Messrs. A. J. Dean, A. O. Hyde, J. C. Sharp, Wm. Ball, I. H. Butterfield, W. L. Webber and Eugene Fifield.

Upon motion of Mr. Butterfield Messrs. Ball and Turner were appointed a committee to secure legislation necessary to enable the Executive Committee to locate the Fair permanently at any special meeting of that committee.

It was agreed to call a meeting of the Executive Committee at the Hibbard House, Jackson, on Wednesday, April 24th next, provided that the committee on legislation secure the passage of a bill giving the comm tte power to locate permanently at that time.

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The President, Treasurer, Secretary, Business Committee and Transportation Committee were, upon motion, appointed a committee on temporary location.

President Palmer then announced the following Committees and Superintendents:

Business—Franklin Wells, Constantine; John C. Sharp, Jackson; I. H. Butterfield, Lapeer.

Transportation—James M. Turner, Lansing; Eugene Fifield, Bay City; J. C. Sterling, Monroe.

Reception—Wm. Chamberlain, Three Oaks; A. O. Hyde, Marshall; H. O. Hanford, Plymouth.

Programme—Geo. W. Phillips, Romeo; I. H. Butterfield, Lapeer; John C. Sharp, Jackson.

Printing and Advertising—A. J. Dean, Adrian; J. C. Sterling, Monroe; Franklin Wells, Constantine.

General Superintendent—H. O. Hanford, Plymouth.

Chief Marshal—Eugene Fifield, Bay City.

Executive Superintendents—Cattle, I. H. Butterfield; Horses, G. W. Phillips; Sheep, D. W. Howard; Swine, M. J. Gard; Poultry, J. Q A. Burrington; Miscellaneous, F. Hart Smith; Art, M. P. Anderson; Music, M. P. Anderson; Children's Department, Wm. Chamberlain; Needle Work, Wm. Chamberlain; Manufactures, Henry Fralick; Agricultural, A. F. Wood; Machinery, H. R. Dewey; Farm Implements, C. W. Young; Dairy Department, J. P. Shoemaker; Vehicles, F. L. Reed; Bees and Honey, N. J. Kelsey; Forage, John Lessiter; Horticultural, L. D. Watkins; Gates, Wm. Ball; Police, N. J. Kelsey.

It was then moved and supported that the matter of raising funds for the Society be referred to the Business Committee with power to act.

Carried.

Upon motion, Ex-President Hyde was appointed Acting President with power to act for President Palmer during his absence.

Upon motion, adjourned.

T. W. PALMER,
President.

J. C. STERLING,
Secretary.

COUNCIL CHAMBER,
JACKSON, *April 24, 1889.*

The Executive Committee met pursuant to the call of the President.

Roll called. Present: President Palmer, Treasurer Dean, Messrs. Hyde, Shoemaker, M. Hanford, Lessiter, Fifield, Smith, Reed, Wood, Turner, Gard, Butterfield, Watkins, Anderson, Wells, and Secretary.

Chairman Turner, from the Committee on Legislation, reported that the Committee had secured the passage of a bill to enable the Executive Committee to locate the Fair permanently at any meeting of that Committee.

Col. Shoemaker and Mr. Dwight Smith, of Jackson, asked that the question of permanent location be postponed thirty days, or until the annual meeting of the Society.

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Mr. Wells moved, and it was supported, that when we adjourn it be to meet at the Hudson House, Lansing, on May 20, at 7:30 P. M.

Carried.

Mr. Dean moved that all matters and all communications relating to temporary location be referred to the Committee on Temporary Location.

Carried.

The same gentleman then offered the following resolution, which was adopted:

Resolved, That the Committee on Temporary Location be instructed to solicit, by advertising in two Detroit papers, for propositions for the temporary location of the State Fair for the current year, said propositions to include description of inducements in the way of grounds, buildings and bonuses, or any of them; and further that the Committee be authorized to visit said points as they may deem advisable, that they may be able to report at the next meeting said propositions and such recommendations as they may deem fit in the premises.

Mr. Wells, by permission, asked to change the time of adjournment to May 13.

Upon motion, granted.

Adjourned.

T. W. PALMER,
President.

J. C. STERLING,
Secretary.

LANSING, *May 13, 1889.*

The Executive Committee met at the Hudson House at 7:30 P. M., as per adjournment.

Roll called. Present: Messrs. Hyde, Dean, Ball, Fifield, Hanford, Gard, Wood, Wells, Burrington, Anderson, Watkins, Young, Reed, Kelsey, Dewey, Butterfield, Lessiter, Turner, Smith, Shoemaker, J. P., Webber, Secretary.

Upon motion of Mr. Butterfield, Mr. Hyde was chosen chairman of the Executive Committee, to act as such during President Palmer's absence.

Mr. Persey Cook invited the Society to locate permanently at Grand Rapids and presented a proposition.

Citizens of Lansing present invited the Society to locate permanently in that city.

Mr. J. E. Warner, President of the Central Michigan Agricultural Society, offered the Society the grounds, buildings, etc., of the Central Society. Representatives of the Lansing Board of Trade agreed to pay all indebtedness of the Central Society.

Mayor Turner stated that the city of Lansing would furnish water free and would have the street railroad track extended to the fair grounds.

Mr. Webber moved that the proposition submitted by the Lansing people be accepted, provided that satisfactory assurance be given in legal form.

After some discussion, the motion was carried and Messrs. Webber, Wells, and Dean appointed a committee to draw up a contract.

A recess of one hour voted.

The committee re-assembled at the appointed time.

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Committee on contract reported.

Report acccepted and adopted and contract signed.

Upon motion, Chairman Hyde was authorized to execute the proper papers on the part of the Society.

Upon motion of Mr. Fifield, the dates of the Fair for 1889 were changed to Sept. 9, 10, 11, 12 and 13.

Upon motion of Mr. Turner, the Speed Committee was requested to confer with the officers of the Central Society in reference to consolidating stake races.

On motion, adjourned until 8 o'clock, Tuesday morning.

A. O. HYDE,
Chairman.

J. C. STERLING,
Secretary.

TUESDAY, *May 14, 1889.*

The committee met as per adjournment.

Chairman Hyde presiding.

Quorum present.

The following changes of Executive Superintendents were announced:

Superintendent Forage, A. F. Wood; Superintendent Police, N. J. Kelsey; Superintendent Bees and Honey, M. J. Gard; Superintendent Agriculture, H. O. Hanford.

Mr. Butterfield tendered his resignation as a member of the Business Committee.

Moved and supported that Mr. Butterfield be requested to withdraw his resignation.

The motion prevailed and Mr. Butterfield consented to act.

Upon motion Mr. Turner was added to the Business Committee.

Chairman Wells stated that a large sum of money would be required to fit the buildings and grounds for the Fair.

Mr. Dean moved, and it was supported, that the Business Committee be and they are hereby authorized to pledge the credit of the Society for money necessary to prepare grounds and buildings.

Carried.

It was then voted to change the rules referring to forage, and that a charge be made for hay.

Mr. Hanford moved that Mr. Young be associated with the Business Committee to locate permanent buildings that any exhibitors of farm implements may desire to build on the Fair grounds.

Carried.

On motion the Business Committee was authorized to locate all buildings and stalls on the grounds.

Adjourned.

A. O. HYDE,
Chairman.

J. C. STERLING,
Secretary.

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LANSING, *June 25, 1889.*

Chairman Hyde, Treasurer Dean, Messrs. Butterfield, Sharp, Turner and Secretary met at the Hudson House at 10:30 A. M.

Acting President Hyde stated that Chairman Wells of the Business Committee had resigned, and that he had appointed Mr. I. H. Butterfield chairman of that committee.

After a visit to the Fair grounds, the committee met at the residence of Mr. Turner.

Upon motion, Mr. Turner was instructed to contract for a grand stand, similar to the one on the Jackson fair grounds, the cost not to exceed $2,500.00. The gross receipts from the stand, including booth rental for 1889, to be paid to the builder, the balance to be paid by the Society's note, payable in one year, at seven per cent interest.

Mr. Geo. W. Phelps was, upon motion, engaged to oversee the work of building, etc., from June 26 to September 15, at $50.00 per month.

It was agreed to build a duplicate of the carriage building now on the grounds.

Adjourned.

J. C. STERLING,
Secretary.

MEETINGS HELD DURING FAIR.

HUDSON HOUSE, LANSING.
Monday, Sept. 9, 1889.

The Executive Committee met at 7:30 P. M.

Chairman Hyde presiding.

Present: Messrs. Hyde, Dean, Fifield, Howard, Hanford, Wood, Gard, Reed, Burrington, Watkins, Young, Kelsey, Butterfield, Lessiter, Shoemaker, J. P. Smith, Fralick, Chamberlain, and Secretary.

Messrs. Sleight, Baird and Whitney, of the Central Society, addressed the committee, and asked that the life members of the Central Society be furnished passes for the State Fair of 1889.

Mr. Wood moved that all life members of the Central Michigan Agricultural Society, who request it, be given a complimentary ticket for the Fair of 1889, said ticket to admit member and wife.

After some discussion and several amendments,

Mr. Reed moved a substitute, that all holders of life memberships in the Central Society be admitted to the Fair of 1889 upon presentation of the proper certificate at the gate, the certificate to be punched for each admission.

Carried.

A number of late entries were read by the Secretary.

It was voted to receive all entries mailed and post-marked the date advertised for closing the same, or previous to that date.

Mr. Wood stated that he had been requested to ask for free admission for the gentlemen representing the Y. M. C. A.

Upon motion the matter was tabled.

Mr. Fralick stated that the directors of the West Michigan Agricultural Society contemplated visiting the Fair during the week.

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Upon motion of Mr. Butterfield the Reception Committee was requested to meet the gentlemen from Grand Rapids at the train, and to provide for their entertainment during their stay in the city.

Voted to hold the annual election in the building on the Fair grounds known as the crop correspondents' building.

Messrs. M. A. Crooks, Kalamazoo, A. Wheeler, Adrian, and R. L. Hewitt, Lansing, were elected judges of election.

Adjourned.

A. O. HYDE,
Chairman.

J. C. STERLING.
Secretary.

TUESDAY EVENING, *Sept. 10, 1889.*

Executive Committee met at the President's office on the Fair grounds at 8 o'clock P. M.

Acting President Hyde presiding.

Roll called. Present: Messrs. Hyde, Dean, Fifield, Howard, Hanford, Reed, Gard, Wood, Burrington, Wells, Anderson, Watkins, Butterfield, Smith, Young, Dewey, Lessiter, Turner, Shoemaker, J. P., Phillips, Fralick, Chamberlain and Secretary.

It was voted to hold a caucus at the President's office on the Fair grounds Wednesday evening at 4:30 o'clock.

A protest against noise made by the Bell City Feed Cutters, near Machinery Hall, was read, and, upon motion, referred to Superintendent Dewey.

Mr. Dean moved that Superintendent Dewey be requested to provide power for the Bell City people at some other point on the grounds, at the expense of the Society.

Carried.

Upon motion of Mr. Wood the price of admission for the evening entertainment was fixed at 25 cents.

On motion, adjourned.

A. O. HYDE,
Chairman.

J. C. STERLING,
Secretary.

MEETING OF THE SOCIETY.

WEDNESDAY, *Sept. 11, 1889.*

Pursuant to published notices, the annual caucus was held at 4:30 P. M.

Mr. C. F. Moore was chosen Chairman and Mr. I. H. Butterfield Secretary.

Moved and supported to proceed to ballot for President.

Carried.

Moved and supported that none but members be allowed to vote, membership to be determined by the books of the Secretary.

Carried.

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On motion, two tellers were appointed by the chairman, H. O. Hanford and A. T. Donaldson.

First ballot, whole number of votes cast, 106. James M. Turner received 64; Samuel Johnson, 39, and B. F. Stockbridge, 3.

Moved and supported to proceed to ballot for Treasurer.

Carried.

A. J. Dean was unanimously chosen.

Moved to proceed to ballot for Secretary.

Carried.

J. C. Sterling was unanimously elected.

The following named persons were then nominated Executive Committeemen: Eugene Fifield, Bay county; John Cole, Newaygo county; James A. Green, Wayne county; M. J. Gard, Cass county; L. W. Barnes, Shiawassee county; W. P. Custard, St. Joseph county; J. Q. A. Burrington, Tuscola county; W. P. Anderson, Midland county; C. E. Lockwood, Macomb county; C. W. Young, Van Buren county.

On motion, the Secretary was instructed to prepare ballots for election.

On motion, adjourned.

C. W. MOORE,
Chairman.

I. H. BUTTERFIELD,
Secretary.

WEDNESDAY EVENING, *Sept. 11, 1889.*

The Executive Committee met at the President's office on the Fair grounds at 8 o'clock P. M.

Roll called, quorum present.

A protest against awards on three-year-old team in Class 18 was read, accepted and referred to Supt. Phillips.

Superintendent reported recommending that the protest be not sustained.

Report accepted and adopted.

Chairman Hyde referred to the accidental shooting of Maj. Kelsey.

Upon motion, the Secretary was instructed to wire regrets and sympathy of the Committee to Maj. Kelsey.

Mr. Turner moved, and it was supported and carried by a unanimous vote, that the Chairman of the Executive Committee see to it that all medical expenses connected with Maj. Kelsey's case be settled by the Society.

On motion, adjourned.

A. O. HYDE,
Chairman.

J. C. STERLING,
Secretary.

THURSDAY EVENING, *Sept. 12, 1889.*

Committee met on Fair grounds at 7:30 P. M.

Chairman Hyde presiding.

Quorum present.

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Supt. Hanford reported for Division F, Agriculture, regular premiums, $358.50 awarded; discretionary recommended, $25; total, $383.50.

Accepted and adopted.

Supt. Howard reported for Division C, Sheep, $1,177 awarded.

Accepted and adopted.

Supt. Chamberlain reported for Division O, needlework, regular premiums $181.50 awarded; discretionary recommended, $8; total, $189.50.

The same Superintendent reported for Division Q, Children's Department, regular premiums, $17.50; discretionary recommended, $3; total, $20.50.

Accepted and adopted.

Supt. Fralick reported for Division L, Manufacturers, regular premiums, $126; discretionary recommended, $13; total, $139.

Accepted and adopted.

Supt. Smith reported for Division P, miscellaneous, regular premiums, $27 awarded.

Accepted and adopted.

The report of the Judges of Election was read, showing the following officers elected:

President—James M. Turner, Ingham county.

Treasurer—A. J. Dean, Lenawee county.

Secretary—Joe C. Sterling, Monroe county.

Executive Committeemen—Eugene Fifield, Bay county; John Cole, Newaygo county; James A. Green, Wayne county; M. J. Gard, Cass county; L. W. Barnes, Shiawassee county; W. P. Custard, St. Joseph county; J. Q. A. Burrington, Tuscola county; M. P. Anderson, Midland county; C. E. Lockwood, Macomb county; C. W. Young, Van Buren county.

Report accepted and adopted.

On motion, adjourned.

A. O. HYDE,
Chairman.

J. C. STERLING,
Secretary.

FRIDAY EVENING, *Sept. 13, 1889.*

Executive Committee met at the Hudson House at 8 o'clock P. M.

I. H. Butterfield was chosen chairman.

Roll called: Quorum present.

Supt. Butterfield reported for Division A, Cattle, regular premiums, $2,775.00 awarded; discretionary premium of $20.00 recommended on a herd of Red Polled cattle; total, $2,795.00.

Accepted and adopted.

Supt. Phillips reported for Division B, Horses, regular premiums, $1,847.00 awarded; speed premiums, $1,340.00 awarded and paid; total, $3,187.00.

Accepted and adopted.

Supt. Lessiter reported for Division B, Swine, regular premiums, $755.00 awarded.

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Accepted and adopted.

Supt. Burrington reported for Division E, Poultry, regular premiums, $217.50 awarded.

Accepted and adopted.

Supt. Shoemaker reported for Division G, Dairy, regular premiums, $105.00 awarded; discretionary premiums recommended, $5.00; total, $110.00.

Accepted and adopted.

Supt. Gard reported for Division H, Bees and Honey, regular premiums, $177.00 awarded.

Accepted and adopted.

Supt. Anderson reported for Division N, Art, regular premiums, $671.00 awarded; discretionary recommended, $28.00; total, $699.00.

Accepted and adopted.

The same Supt. reported for Division M, Musical Instruments, etc., regular premiums, $9.00 awarded.

Accepted and adopted.

Supt. Watkins reported for Division R, Horticulture, regular premiums $525.00 awarded; discretionary recommended, $15.00; total, $540.00.

Accepted and adopted.

Messrs. A. I. Barber and M. Farrel stated that there was a misunderstanding concerning the stake races, and that they would like to have the matter settled.

Upon motion, the Secretary was instructed to lay the matter before Secy. Steiner of the American Trotting Association for his decision.

Mr. Reed moved that all members of the Executive Committee who contemplate visiting the Detroit Exposition, be requested to meet at The Wayne, Detroit, on Friday, Sept. 20, at 10 o'clock A. M.

Carried.

Treasurer Dean reported gate receipts for the week, $17,687.50.

A protest against the awards in Class 14, Division B, was read and upon motion referred to Supt. Phillips.

Mr. Reed moved and it was supported that the Business Committee be instructed to approve no bills for improvements on buildings or grounds until the grounds are deeded to the Society.

Carried.

Upon motion of Mr. J. P. Shoemaker, Treasurer Dean was instructed to call upon the proper parties and demand a deed of the Fair grounds.

Adjourned.

I. H. BUTTERFIELD,
Chairman.

J. C. STERLING,
Secretary.

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OFFICIAL LIST OF PREMIUMS AWARDED AT THE FORTY-FIRST ANNUAL FAIR OF THE MICHIGAN STATE AGRICULTURAL SOCIETY, HELD AT LANSING, SEPTEMBER 9-14, 1889.

DIVISION A—CATTLE.

CLASS 1—SHORTHORNS.

Best bull, 3 years old or over, Lessiter & Sons, Cole	$20 00
2d do., Jas. M. Turner, Lansing	15 00
3d do., Benj. F. Batcheler, Osceola Center	10 00
Best bull, 2 years old, Lessiter & Sons, Cole	20 00
2d do., Amos Parmenter, Vernon	15 00
3d do., Perry Brown, Vernon	10 00
Best bull, 1 year old, Bray Bros. & Loomis, St. Johns	15 00
2d do., Jas. M. Turner, Lansing	10 00
3d do., A. A. Wood, Saline	5 00
Best bull calf, under 1 year old, Lessiter & Sons, Cole	12 00
2d do., A. A. Wood, Saline	8 00
3d do., Lessiter & Sons, Cole	5 00
Best cow, 4 years old or over, Jas. M. Turner, Lansing	20 00
2d do., Jas. M. Turner, Lansing	15 00
3d do., The A. P. Cook Co., L'd., Brooklyn	10 00
Best cow, 3 years old, Jas. M. Turner, Lansing	20 00
2d do., Jas. M. Turner, Lansing	15 00
3d do., Jas. M. Turner, Lansing	10 00
Best heifer, 2 years old, Jas. M. Turner, Lansing	20 00
2d do., Benj. F. Batcheler, Osceola Center	15 00
3d do., Lessiter & Sons, Cole	10 00
Best yearling heifer, Jas. M. Turner, Lansing	15 00
2d do., Jas. M. Turner, Lansing	10 00
3d do., Lessiter & Sons, Cole	5 00
Best heifer calf, under 1 year old, Lessiter & Sons, Cole	12 00
2d do., A. F. Wood, Mason	8 00
3d do., Jas. M. Turner, Lansing	5 00
Best herd of Shorthorns, Jas. M. Turner, Lansing	35 00
2d do., Lessiter & Sons, Cole	25 00
3d do., A. F. Wood, Mason	20 00
Best bull and 4 of his get, over 6 months old, Lessiter & Sons, Cole	20 00
2d do., Jas. M. Turner, Lansing	15 00
3d do., Benj. F. Batcheler, Osceola Center	10 00

R. BAKER, *Judge.*

CLASS 2—DEVONS.

Best bull, 3 years old or over, R. G. Hart, Lapeer	$20 00
2d do., E. T. Doney, Jackson	15 00
Best bull, 1 year old, Gavin Longmuir, Pontiac	15 00
2d do., E. T. Doney, Jackson	10 00
Best bull calf, under 1 year old, Gavin Longmuir, Pontiac	12 00
2d do., H. L. Carrier, Brookfield	8 00
3d do., E. T. Doney, Jackson	5 00
Best cow, 4 years old or over, H. L. Carrier, Brookfield	20 00
2d do., R. G. Hart, Lapeer	15 00
3d do., Gavin Longmuir, Pontiac	10 00

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Best cow, 3 years old, R. G. Hart, Lapeer	$20 00
2d do., Gavin Longmuir, Pontiac	15 00
3d do., E. T. Doney, Jackson	10 00
Best heifer, 2 years old, Gavin Longmuir, Pontiac	20 00
2d do., R. G. Hart, Lapeer	15 00
3d do., H. L. Carrier, Brookfield	10 00
Best yearling heifer, E. T. Doney, Jackson	15 00
2d do., Gavin Longmuir, Pontiac	10 00
3d do., H. L. Carrier, Brookfield	5 00
Best heifer calf, under 1 year old, Gavin Longmuir, Pontiac	12 00
2d do., E. T. Doney, Jackson	8 00
3d do., H. L. Carrier, Brookfield	5 00

W. J. G. DEAN, *Judge.*

CLASS 3—HEREFORDS.

Best bull, 3 years old or over, Merrill & Fifield, Bay City	$20 00
2d do., Guy Henning, Wheatfield	15 00
3d do., Jas. M. Turner, Lansing	10 00
Best bull, 1 year old, Merrill & Fifield, Bay City	15 00
2d do., Merrill & Fifield, Bay City	10 00
3d do., R. G. Hart, Lapeer	5 00
Best bull calf, under 1 year old, Merrill & Fifield, Bay City	12 00
2d do., Jas. M. Turner, Lansing	8 00
3d do., Jas. M. Turner, Lansing	5 00
Best cow, 4 year old or over, Merrill & Fifield, Bay City	20 00
2d do., Merrill & Fifield, Bay City	15 00
3d do., Guy Henning, Wheatfield	10 00
Best cow, 3 years old, Jas. M. Turner, Lansing	20 00
2d do., Merrill & Fifield, Bay City	15 00
3d do., Guy Henning, Wheatfield	10 00
Best heifer, 2 years old, Merrill & Fifield, Bay City	20 00
2d do., Jas. M. Turner, Lansing	15 00
3d do., Guy Henning, Wheatfield	10 00
Best yearling heifer, Merrill & Fifield, Bay City	15 00
2d do., Jas. M. Turner, Lansing	10 00
3d do., Merrill & Fifield, Bay City	5 00
Best heifer calf, under 1 year old, Merrill & Fifield, Bay City	12 00
2d do., Jas. M. Turner, Lansing	8 00
3d do., Guy Henning, Wheatfield	5 00
Best herd of Herefords, Merrill & Fifield, Bay City	35 00
2d do., Guy Henning, Wheatfield	25 00
3d do., Jas. M. Turner, Lansing	20 00
Best bull and 4 of get, over 6 months old, Merrill & Fifield, Bay City	20 00

R. BAKER, *Judge.*

CLASS 4—JERSEYS.

Best bull, 3 years old or over, O. J. Bliss, Silver Creek	$20 00
2d do., Anderson Bros., Midland	15 00
3d do., Wm. R. Montgomery, Hillsdale	10 00
Best bull, 2 years old, W. J. G. Dean, Hanover	20 00
2d do., O. J. Bliss, Silver Creek	15 00
Best bull, 1 year old, G. B. Smith, Eagle	15 00
2d do., Wm. R. Montgomery, Hillsdale	10 00
3d do., Chas. L. Halladay, Sebewa	5 00
Best bull calf, under 1 year old, O. J. Bliss, Silver Creek	12 00
2d do., W. J. G. Dean, Hanover	8 00
3d do., G. B. Smith, Eagle	5 00
Best cow, 4 years old or over, G. B. Smith, Eagle	20 00
2d do., W. J. G. Dean, Hanover	15 00
3d do., Wm. R. Montgomery, Hillsdale	10 00
Best cow, 3 years old, W. J. G. Dean, Hanover	20 00
2d do., O. J. Bliss, Silver Creek	15 00
3d do., G. B. Smith, Eagle	10 00

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Best heifer, 2 years old, W. J. G. Dean, Hanover	$20 00
2d do., G. B. Smith, Eagle	15 00
3d do., W. J. G. Dean, Hanover	10 00
Best yearling heifer, W. J. G. Dean, Hanover	15 00
2d do., Wm. R. Montgomery, Hillsdale	10 00
3d do., G. B. Smith, Eagle	5 00
Best heifer calf, under 1 year old, W. J. G. Dean, Hanover	12 00
2d do., G. B. Smith, Eagle	8 00
3d do., Wm. R. Montgomery, Hillsdale	5 00
Best herd of Jerseys, W. J. G. Dean, Hanover	35 00
2d do., G. B. Smith, Eagle	25 00
3d do., O. J. Bliss, Silver Creek	20 00
Best bull and 4 of get, over 6 months old, W. J. G. Dean, Hanover	20 00
2d do., Wm. R. Montgomery, Hillsdale	15 00
3d do., Anderson Bros., Midland	10 00

W. C. NORTON, *Judge*,
Aldenville, Pa.

CLASS 5—GALLOWAYS AND POLLED ANGUS.

Best bull, 3 years old or over, S. J. Murphy, Detroit	$20 00
2d do., C. W. & L. P. Tubbs, Kalamo	15 00
3d do., Wm. P. Darrow, Jefferson	10 00
Best bull, 1 year old, S. J. Murphy, Detroit	15 00
2d do., C. W. & L. P. Tubbs, Kalamo	10 00
Best bull calf, under 1 year old, S. J. Murphy, Detroit	12 00
2d do., S. J. Murphy, Detroit	8 00
3d do., C. W. & L. P. Tubbs, Kalamo	5 00
Best cow, 4 years old or over, Wm. P. Darrow, Jefferson	20 00
2d do., Wm. P. Darrow, Jefferson	15 00
3d do., Wm. Keith, Pittsford	10 00
Best cow, 3 years old, S. J. Murphy, Detroit	20 00
2d do., S. J. Murphy, Detroit	15 00
3d do., S. J. Murphy, Detroit	10 00
Best heifer, 2 years old, S. J. Murphy, Detroit	20 00
2d do., Wm. P. Darrow, Jefferson	15 00
Best yearling heifer, S. J. Murphy, Detroit	15 00
2d do., S. J. Murphy, Detroit	10 00
3d do., S. J. Murphy, Detroit	5 00
Best heifer calf, under 1 year old, S. J. Murphy, Detroit	12 00
2d do., Wm. Keith, Pittsford	8 00
3d do., S. J. Murphy, Detroit	5 00

R. BAKER, *Judge.*

CLASS 6—HOLSTEIN-FRIESIANS.

Best bull, 3 years old or over, A. E. Riley, Walled Lake	$20 00
2d do., Frank W. Parks, Romeo	15 00
3d do., H. P. Smith, East Saginaw	10 00
Best bull, 2 years old, T. D. Seeley & Co., Bay City	20 00
2d do., Mills Bros., Ann Arbor	15 00
3d do., H. P. Smith, East Saginaw	10 00
Best bull, 1 year old, H. P. Smith, East Saginaw	15 00
2d do., W. K. Sexton, Howell	10 00
3d do., Olds & Bacon, York	5 00
Best bull calf, under 1 year old, T. D. Seeley & Co., Bay City	12 00
2d do., A. E. Riley, Walled Lake	8 00
3d do., Mills Bros., Ann Arbor	5 00
Best cow, 4 years old or over, T. D. Seeley & Co., Bay City	20 00
2d do., H. P. Smith, East Saginaw	15 00
3d do., W. K. Sexton, Howell	10 00
Best cow, 3 years old, H. P. Smith, East Saginaw	20 00
2d do., Frank W. Parks, Romeo	15 00
3d do., W. K. Sexton, Howell	10 00

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Best heifer, 2 years old, A. E. Riley, Walled Lake	$20 00
2d do., T. D. Seeley & Co, Bay City	15 00
3d do., Olds & Bacon, York	10 00
Best yearling heifer, A. E. Riley, Walled Lake	15 00
2d do., Olds & Bacon, York	10 00
3d do., Jno. B. Nickle, Hoytville	5 00
Best heifer calf, under 1 year old, Philo L. Daniels, Lansing	12 00
2d do., Frank W. Parks, Romeo	8 00
3d do., W. K. Sexton, Howell	5 00
Best herd of Holstein-Friesians, T. D. Seeley & Co., Bay City	35 00
2d do., A. E. Riley, Walled Lake	25 00
3d do., H. P. Smith, East Saginaw	20 00
Best bull and 4 of get, over 6 months old, A. E. Riley, Walled Lake	20 00
2d do., W. K. Sexton, Howell	15 00
3d do., Frank W. Parks, Romeo	10 00

F. I. MANN, *Judge.*

CLASS 7—GRADE CATTLE.

Best cow, 4 years old or over, David Miller, Clarkston	$20 00
2d do., A. P. Cook Co., Limited, Brooklyn	15 00
3d do., Mills Bros., Ann Arbor	10 00
Best cow, 3 years old, David Miller, Clarkston	20 00
2d do., A. P. Cook Co., L'd., Brooklyn	15 00
3d do., David Miller, Clarkston	10 00
Best heifer, 2 years old, Bray Bros. & Loomis, St. Johns	20 00
2d do., A. P. Cook Co., L'd, Brooklyn	15 00
3d do., David Miller, Clarkston	10 00
Best yearling heifer, F. A. Townley, Tompkins	15 00
2d do., Jno. B. Nickle, Hoytville	10 00
3d do., A. P. Cook Co., L'd, Brooklyn	5 00
Best heifer calf, David Miller, Clarkston	12 00
2d do., F. A. Townley, Tompkins	8 00
3d do., A. P. Cook Co., L'd, Brooklyn	5 00
Best milch cow, 3 years old or over, Mills Bros., Ann Arbor	15 00
2d do., David Miller, Clarkston	10 00

W. J. G. DEAN, *Judge.*

CLASS 8—FAT CATTLE.

Best steer, 3 years old and under 4, A. E. Riley, Walled Lake	$20 00
2d do., A. E. Riley, Walled Lake	15 00
3d do., H. H. Hinds, Stanton	10 00
Best steer, 2 years old and under 3, F. A. Townley, Tompkins	20 00
2d do., Jas. M. Turner, Lansing	15 00
3d do., Jas. M. Turner, Lansing	10 00
Best steer, 1 year old and under 2, F. A. Townley, Tompkins	15 00
2d do., Jas. M. Turner, Lansing	10 00
3d do., F. A. Townley, Tompkins	5 00
Best steer calf, 6 months old and under 1 year, Jas. M. Turner, Lansing	15 00
2d do., F. A. Townley, Tompkins	10 00
3d do., Jas. M. Turner, Lansing	5 00
Best herd of 5 fat cattle, under 4 years old, F. A. Townley, Tompkins	30 00
2d do., Jas. M. Turner, Lansing	20 00
3d do., H. H. Hinds, Stanton	10 00
Best steer, 2 years old and under 3, that shows greatest weight for age in days, F. A. Townley, Tompkins	15 00
Best steer, 1 year old and under 2, showing greatest weight for age in days, F. A. Townley, Tompkins	15 00

R. BAKER,
JOHN LESSITER,
Judges.

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SPECIALS.

Holstein-Friesian cow making best 1 day butter record, T. D. Seeley & Co., Bay City.....Gold medal and	$100 00
2d do., H. P. Smith, East Saginaw	50 00
Holstein-Freisian cow making best 1 day milk record, H. P. Smith, East Saginaw.....Gold medal and	100 00
2d do., T. D. Seeley & Co., Bay City	50 00
Best herd of Holstein-Friesian cattle, T. D. Seeley & Co., Bay City	100 00

NON-ENUMERATED.

Five head Red Polled cattle, J. M. Knapp, Bellevue	$20 00

DIVISION B—HORSES.

CLASS 9—CLEVELAND BAYS AND FRENCH COACH HORSES.

Best stallion, 4 years old or over, Wm. Hewitt, Campbell	$20 00
2d do., E. Helber, Saline	15 00
Best stallion, 3 years old, Dorr Prairie Live Stock Ass'n, Dorr Village, Ind.	20 00
2d do., Cleveland Bay Horse Co., Paw Paw	15 00
Best stallion, 2 years old, Cleveland Bay Horse Co., Paw Paw	12 00
2d do., C. B. Truesdell, Wayne	8 00
Best stallion, 1 year old, Cleveland Bay Horse Co., Paw Paw	10 00
2d do., Dorr Prairie Live Stock Ass'n, Dorr Village, Ind.	6 00
Best brood mare, 4 years old or over, with foal by side, Cleveland Bay Horse Co., Paw Paw	20 00
Best mare, 4 years old or over, without colt, E. Helber, Saline	15 00
2d do., Cleveland Bay Horse Co., Paw Paw	12 00
Best mare, 3 years old, Cleveland Bay Horse Co., Paw Paw	12 00
Best mare, 2 years old, C. B. Truesdell, Wayne	10 00
Best filly colt, Cleveland Bay Horse Co., Paw Paw	6 00

B. D. TAGGART,
WM. ANDERSON,
Judges.

CLASS 10—THOROUGHBREDS.

Best stallion, 4 years old or over, H. H. Waters, Ovid	$20 00
2d do., Garrett Post, Chesaning	15 00
Best stallion, 2 years old, P. H. Hagle, Pontiac	12 00
Best mare, four years old or over, without colt, P. H. Hagle, Pontiac	15 00
Best mare, 3 years old, P. H. Hagle, Pontiac	12 00

B. D. TAGGART,
WM. ANDERSON,
Judges.

CLASS 11—HORSES OF ALL WORK.

Best stallion, 4 years old or over, P. H. Rice, Kalamazoo	$20 00
2d do., A. C. Clark, Lansing	15 00
3d do., N. C. Branch, Williamston	10 00
Best stallion, 3 years old, Frank Brokaw, Eagle	20 00
2d do., Elmer Sheets, Grand Ledge	15 00
Best stallion, 2 years old, Cleveland Bay Horse Co., Paw Paw	12 00
2d do., P. Van Riper, Onondaga	10 00
3d do., H. Byam & Son, Grand Ledge	8 00
Best stallion, 1 year old, Thos. Maxwell, Lawton	8 00
2d do., Loui Bouts, Holt	5 00
3d do, A. O. Parmenter, Grand Ledge	3 00
Best brood mare, 4 years old or over, with foal by side, H. N. Yuncker, Lansing	20 00
2d do., J. S. Valentine, Lansing	15 00
3d do., Jacob P. Sleight, Bath	10 00

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Best mare, 3 years old, Cleveland Bay Horse Co., Paw Paw	$10 00
2d do., A. C. Clark, Lansing	8 00
3d do., Cleveland Bay Horse Co., Paw Paw	4 00
Best mare, 2 years old, Jno. Francis, Delta	8 00
2d do., A. O. Parmenter, Grand Ledge	5 00
3d do., Wm. Sutherland, Eagle	3 00
Best mare, 1 year old, Loui Bouts, Holt	7 00
2d do., Thos. Maxwell, Lawton	5 00
3d do., Jno. Francis, Delta	3 00
Best filly colt, H. N. Yuncker, Lansing	5 00
2d do., Jacob P. Sleight, Bath	3 00
3d do , J. S. Valentine, Lansing	2 00
Best gelding, 4 years old or over, Jno. I. Shaver, St. Johns	12 00
2d do., A. O. Parmenter, Grand Ledge	8 00
Best gelding, 3 years old, A. C. Clark, Lansing	10 00
2d do., Chas. L. Clark, St. Johns	8 00
3d do., A. O. Parmenter, Grand Ledge	5 00
Best gelding, 1 year old, O. M. Robertson, Eaton Rapids	6 00
2d do., A. C. Clark, Lansing	4 00
3d do., Will N. Adams & Thomas, Jackson	2 00
Best pair matched horses, 5 years old or over, Thos. Maxwell, Lawton	20 00
2d do., J. W. Post, North Lansing	15 00
Best pair matched horses, 3 years old, Thos. Maxwell, Lawton	15 00

JAS. DAVIDSON,
JOSHUA VANHOOSEN,
Judges.

CLASS 12—ROADSTERS.

Best stallion, 5 years old or over, Henry Brown, Battle Creek	$20 00
2d do., R. G. Hart, Lapeer	15 00
3d do., Wing & Teasdale, Howell	10 00
Best stallion, 4 years old, Chas. R. Durand, Jackson	20 00
Best stallion, 3 years old, Robt. Gould & Son, Ceresco	20 00
2d do., A. P. Thurston, Burr Oak	15 00
3d do., E. H. Williams, Mason	10 00
Best mare or gelding, 5 years old or over, R. G. Hart, Lapeer	15 00
Best mare or gelding, 4 years old, W. J. G. Dean, Hanover	12 00
2d do., R. W. Becker, Mason	8 00
3d do., N. C. Branch, Williamston	4 00
Best mare or gelding, 3 years old, R. W. Becker, Mason	10 00
2d do., Henry Brown, Battle Creek	6 00
3d do., W. H. Schantz, Hastings	4 00

B. D. TAGGART,
WM. ANDERSON,
S. A. COLBY,
Judges.

CLASS 13—BREEDERS' STOCK.

Best stallion, two years old, Guy Henning, Wheatfield	$12 00
2d do., Dunham & Bowen, Bellevue	8 00
3d do., A. N. Harrington, Okemos	5 00
Best stallion, 1 year old, W. J. G. Dean, Hanover	10 00
2d do., H. L. Bryant, Burr Oak	6 00
3d do., Dr. N. A. Dryer, Bath	4 00
Best stallion colt, David J. Potter, Aurelius	7 00
2d do., Jas. J. Baird, Lansing	5 00
Best brood mare, 4 years old or over, with foal by side, David J. Potter, Aurelius	20 00
2d do., Jas. J. Baird, Lansing	15 00
3d do., A. D. Barnes, Laingsburg	10 00
Best mare, 2 years old, Robt. Gould & Son, Ceresco	8 00
2d do., H. L. Bryant, Burr Oak	5 00
3d do., Levi Swan, Dansville	3 00

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Best mare, 1 year old, David J. Potter, Aurelius	$7 00
2d do., Robt. Gould & Son, Ceresco	5 00
3d do., O. M. Robertson, Eaton Rapids	2 00
Best mare colt, Jas. Ferguson, Okemos	5 00
2d do., A. D. Barnes, Laingsburg	3 00

JAS. DAVIDSON,
JOSHUA VANHOOSEN,
Judges.

CLASS 14—GENTS' DRIVING HORSES TO ROAD WAGON.

Best pair driving horses, not kept for sporting purposes, C. J. Gale, Corunna	$20 00
Best single mare or gelding, 5 years old or over, H. M. Williams, Mason	20 00
2d do., D. N. Tripp, Coldwater	15 00
3d do., Jos. K. Moss, Grand Ledge	10 00
Best single mare or gelding, 4 years old, Silas Hoyt, Jackson	20 00
2d do., J. Cudhy, Marshall	15 00

B. D. TAGGART,
WM. ANDERSON,
S. A. COLBY,
Judges.

CLASS 15—CLYDESDALE, OR ENGLISH SHIRE HORSES, REGISTERED.

Best stallion, 4 years old or over, Chas. E. Porter, Wyoming, Ont.	$20 00
2d do., C. B. Truesdell, Wayne	15 00
3d do., Hastings Horse Ass'n, Hastings	10 00
Best stallion, 3 years old, Jas. M. Turner, Lansing	20 00
2d do., Dorr Prairie Live Stock Ass'n, Dorr Village, Ind.	12 00
3d do., Jno. Schipper, Overisel	8 00
Best stallion, 2 years old, Dorr Prairie Live Stock Ass'n, Dorr Village, Ind.	10 00
2d do., Jas. M. Turner, Lansing	6 00
3d do., W. A. Wilder, West Bay City	4 00
Best stallion, 1 year old, E. Helber, Saline	8 00
2d do., Jas. M. Turner, Lansing	5 00
Best stallion colt, Jas. M. Turner, Lansing	5 00
Best mare, 4 years old or over, Jas. M. Turner, Lansing	15 00
Best mare, 3 years old, Dorr Prairie Live Stock Ass'n, Dorr Village, Ind.	12 00
2d do., Jas. M. Turner, Lansing	8 00
Best mare, 2 years old, Dorr Prairie Live Stock Ass'n, Dorr Village, Ind.	12 00
2d do., Jas. M. Turner, Lansing	6 00
3d do., Jas. M. Turner, Lansing	4 00
Best filly colt, Jas. M. Turner, Lansing	5 00

JAS. DAVIDSON,
JOSHUA VANHOOSEN,
Judges.

CLASS 16—PERCHERON FRENCH DRAFT HORSES, REGISTERED.

Best stallion, 4 years old or over, Davis & McRae, Mt. Pleasant	$20 00
2d do., Trubey Bros., Colon	15 00
3d do., H. Byam & Son, Grand Ledge	10 00
Best stallion, 2 years old, Jno. Schipper, Overisel	10 00
Best stallion, 1 year old, Jacob P. Sleight, Bath	8 00
2d do., R. G. Hart, Lapeer	5 00
Best stallion colt, W. B. Otto, Charlotte	5 00
2d do., Jacob P. Sleight, Bath	3 00
Best mare, 4 years old or over, Jacob P. Sleight, Bath	15 00
2d do., W. B. Otto, Charlotte	12 00
3d do., R. G. Hart, Lapeer	8 00
Best mare, 3 years old, Jacob P. Sleight, Bath	12 00
Best mare, 2 years old, Jacob P. Sleight, Bath	10 00
Best mare, 1 year old, R. G. Hart, Lapeer	8 00

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Best filly colt, Jacob P. Sleight, Bath	$5 00
2d do., R. G. Hart Lapeer	3 00

JAS. DAVIDSON,
JOSHUA VANHOOSEN,
Judges.

CLASS 17—DRAFT HORSES, PEDIGREE NOT REQUIRED.

Best pair mares or geldings, 4 years old or over, R. G. Hart, Lapeer	$20 00
2d do., Wm. A. Melton, Mason	15 00
3d do., W. B. Otto, Charlotte	10 00
Best mare, 4 years old or over, Geo. Dysinger, Ionia	15 00
2d do., James M. Turner, Lansing	12 00
3d do., Geo. Dysinger, Ionia	8 00
Best mare, 3 years old, Jacob P. Sleight, Bath	12 00
2d do., Jacob P. Sleight, Bath	8 00
3d do., James M. Turner, Lansing	5 00
Best mare or gelding, 2 years old, Chas. L. Clark, St. Johns	10 00
2d do., Jas. M. Turner, Lansing	6 00
3d do., Wm. Ward, Eaton Rapids	4 00
Best mare or gelding, 1 year old, E. S. Doty, Eagle	8 00
2d do., James M. Turner, Lansing	5 00
Best colt, Geo. Dysinger, Ionia	5 00
2d do., James M. Turner, Lansing	3 00
3d do., Jacob P. Sleight, Bath	2 00

B. D. TAGGART,
WM. ANDERSON,
Judges.

CLASS 18—CARRIAGE AND BUGGY HORSES (MARES OR GELDINGS.)

Best pair matched carriage horses, 16 hands or over, and 5 years old or over, A. J. Bennett, Mason	$20 00
Best pair matched carriage horses, under 16 hands, and 4 years old or over, A. J. Bennett, Mason	20 00
2d do., C. J. Gale, Corunna	15 00
3d do., Jas. Ferguson, Okemos	10 00
Best single carriage or buggy horse or mare, 4 years old or over, J. Cudhy, Marshall	12 00
2d do., E. W. Davis, Lansing	8 00
3d do., A. D. Barnes, Laingsburg	4 00
Best single carriage or buggy horse or mare, 3 years old, D. Dodge, Mason	10 00

B. D. TAGGART,
WM. ANDERSON,
S. A. COLBY,
Judges.

CLASS 19—ROADSTERS—MARES AND GELDINGS.

Best, 5 years old or over, C. J. Davis, Lansing	$20 00
2d do., Thos. Marshall, Lansing	15 00
Best, 4 years old, Elmer Hatch, Horton	20 00
2d do., C. E. Davis, Lansing	15 00
Best, 3 years old, Henry Darrow, Charlotte	20 00
2d do., Robt. Gould & Son, Ceresco	15 00
3d do., Elmer Hatch, Horton	10 00
Best, 2 years old, C. E. Ball, Mason	12 00
2d do., John Kelsey, Lansing	8 00
3d do., R. G. Hart, Lapeer	5 00

B. D. TAGGART,
WM. ANDERSON,
S. A. COLBY,
Judges.

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CLASS 20—SWEEPSTAKES FOR STALLIONS WITH FIVE COLTS OF HIS OWN GET.

Best thoroughbred stallion, H. H. Waters, Ovid	$20 00
Best all work stallion, D. S. King, Lansing	20 00
2d do., A. O. Parmenter, Grand Ledge	15 00
Best roadster stallion (standard bred), A. I. Barber, Mason	20 00
2d do., Henry Brown, Battle Creek	15 00
Best Percheron or French draft stallion, Jacob P. Sleight, Bath	20 00
2d do., H. Byam & Son, Grand Ledge	15 00

B. D. TAGGART,
S. A. COLBY,
WM. ANDERSON,
JAS. DAVIDSON,
JOSHUA VANHOOSEN,
Judges.

DIVISION C—SHEEP.

CLASS 21—THOROUGHBRED AMERICAN MERINOS.

Best ram, 3 years old or over, Short & Harrington, Coldwater	$15 00
2d do., F. C. Wood, Saline	12 00
3d do., L. W. & O. Barnes, Byron	8 00
Best ram, 2 years old, A. A. Wood, Saline	15 00
2d do., L. W. & O. Barnes, Byron	12 00
3d do., Amos Parmenter, Vernon	8 00
Best ram, 1 year old, Short & Harrington, Coldwater	15 00
2d do., Short & Harrington, Coldwater	12 00
3d do., L. W. & O. Barnes, Byron	8 00
Best ram lamb, A. A. Wood, Saline	8 00
2d do., A. A. Wood, Saline	6 00
3d do., L. W. & O. Barnes, Byron	4 00
Best ewe, 3 years old and over, A. A. Wood, Saline	15 00
2d do., A. A. Wood, Saline	12 00
3d do., F. C. Wood, Saline	8 00
Best ewe, 2 years old, N. A. Wood, Saline	15 00
2d do., A. A Wood, Saline	12 00
3d do., L. W. and & O. Barnes, Byron	8 00
Best ewe, 1 year old, F. C. Wood, Saline	15 00
2d do., F. C. Wood, Saline	12 00
3d do., N. A. Wood, Saline	8 00
Best ewe lamb, A. A. Wood, Saline	8 00
2d do., N. A. Wood, Saline	6 00
3d do., Amos Parmenter, Vernon	4 00

C. E. LOCKWOOD,
D. C. HODGE,
J. E. HORNER,
Judges.

CLASS 22—FINE WOOL GRADES.

Best ewe, 3 years old or over, L. W. & O. Barnes, Byron	$6 00
2d do., L. W. & O. Barnes, Byron	4 00
Best ewe, 2 years old, C. Bahan, Palo	6 00
2d do., L. W. & O. Barnes, Byron	4 00
3d do., L. W. & O. Barnes, Byron	2 00
Best ewe, 1 year old, C. Bahan, Palo	6 00
Best ewe lamb, L. W. & O. Barnes, Byron	4 00
2d do., C. Bahan, Palo	3 00
3d do., L. W. & O. Barnes, Byron	2 00

D. C. HODGE,
C. E. LOCKWOOD,
Judges.

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CLASS 23—COTSWOLDS AND LINCOLNS.

Best ram, 2 years old or over, Montgomery & Westfall, Hillsdale	$15 00
2d do., Frank Willson, Jackson	10 00
3d do., Buck Bros., Portland	6 00
Best ram, 1 year old, Frank Willson, Jackson	12 00
2d do., G. S. Allen & Son, Portland	8 00
3d do., Frank Willson, Jackson	5 00
Best ram lamb, Montgomery & Westfall, Hillsdale	10 00
2d do., Mrs. Ann Newton, Pontiac	6 00
3d do., Montgomery & Westfall, Hillsdale	4 00
Best ewe, 2 years old or over, Montgomery & Westfall, Hillsdale	15 00
2d do., Montgomery & Westfall, Hillsdale	10 00
3d do., Frank Willson, Jackson	6 00
Best ewe, 1 year old, Montgomery & Westfall, Hillsdale	12 00
2d do., Montgomery & Westfall, Hillsdale	8 00
3d do., Frank Willson, Jackson	5 00
Best ewe lamb, Montgomery & Westfall, Hillsdale	10 00
2d do., G. S. Allen & Son, Portland	6 00
3d do., Mrs. Ann Newton, Pontiac	4 00

G. HOWARD,
E. S. DAY,
LOREN ANDREWS,
Judges.

CLASS 24—LEICESTERS.

Best ram, 2 years old or over, Mrs. Ann Newton, Pontiac	$15 00
2d do., Henry Mitton, Ridgetown, Ont.	10 00
3d do., A. F. Wood, Mason	6 00
Best ram, 1 year old, Henry Mitton, Ridgetown, Ont.	12 00
2d do., Henry Mitton, Ridgetown, Ont.	8 00
3d do., Mrs. Ann Newton, Pontiac	5 00
Best ram lamb, Henry Mitton, Ridgetown, Ont.	10 00
2d do., Henry Mitton, Ridgetown, Ont.	6 00
3d do., Mrs. Ann Newton, Pontiac	4 00
Best ewe, 2 years old or over, Mrs. Ann Newton, Pontiac	15 00
2d do., Henry Mitton, Ridgetown, Ont.	10 00
3d do., Henry Mitton, Ridgetown, Ont.	6 00
Best ewe, 1 year old, Henry Mitton, Ridgetown, Ont.	12 00
2d do., Mrs. Ann Newton, Pontiac	8 00
3d do., Henry Mitton, Ridgetown, Ont.	5 00
Best ewe lamb, Henry Mitton, Ridgetown, Ont.	10 00
2d do., F. A. Wood, Mason	6 00
3d do., Mrs. Ann Newton, Pontiac	4 00

G. HOWARD,
E. S. DAY,
L. ANDREWS,
Judges.

CLASS 25—SHROPSHIRES.

Best ram, 3 years old or over, Mrs. Ann Newton, Pontiac	$15 00
2d do., Geo. W. Button, Flushing	12 00
3d do., Montgomery & Westfall, Hillsdale	8 00
Best ram, 2 years old, R. R. Smith, Howell	15 00
Best ram, 1 year old, Jno. Milton, Marshall	15 00
2d do., R. R. Smith, Howell	12 00
3d do., Geo. W. Button, Flushing	8 00
Best ram lamb, Jno. Milton, Marshall	8 00
2d do., Geo. W. Button, Flushing	6 00
3d do., James M. Turner, Lansing	4 00
Best ewe, 3 years old or over, Mrs. Ann Newton, Pontiac	15 00
2d do., James M. Turner, Lansing	12 00
3d do., James M. Turner, Lansing	8 00

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Best ewe, 2 years old, J. Corbitt, Ionia	$15 00
2d do., Wm. K. Crafts, Grass Lake	12 00
3d do., Wm. K. Crafts, Grass Lake	8 00
Best ewe, 1 year old, Jno. Milton, Marshall	15 00
2d do., J. Corbitt, Ionia	12 00
3d do., Geo. W. Button, Flushing	8 00
Best ewe lamb, R. R. Smith, Howell	8 00
2d do., R. R. Smith, Howell	6 00
3d do., James M. Turner, Lansing	4 00

G. HOWARD.
E. S. DAY,
L. ANDREWS,
Judges.

CLASS 26—HAMPSHIRES.

Best ram, 2 years old or over, Mrs. Ann Newton, Pontiac	$15 00
2d do., J. H. Taft, Mendon	10 00
Best ram, 1 year old, Mrs. Ann Newton, Pontiac	12 00
2d do., J. H. Taft, Mendon	8 00
3d do., Jno. Moriarity, Hudson	5 00
Best ram lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., Mrs. Ann Newton, Pontiac	6 00
3d do., J. H. Taft, Mendon	4 00
Best ewe, 2 years old or over, Mrs Ann Newton, Pontiac	15 00
2d do., Mrs. Ann Newton, Pontiac	10 00
3d do., J. H. Taft, Mendon	6 00
Best ewe, 1 year old, Mrs. Ann Newton, Pontiac	12 00
2d do., Jno. Milton, Marshall	8 00
3d do., Mrs. Ann Newton, Pontiac	5 00
Best ewe lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., J. H. Taft, Mendon	6 00
3d do., Jno. Moriarity, Hudson	4 00

G. HOWARD,
E. S. DAY,
L. ANDREWS,
Judges.

CLASS 27—OXFORDS.

Best ram, 2 years old or over, Mrs. Ann Newton, Pontiac	$15 00
2d do., Frank Willson, Jackson	10 00
3d do., Frank Willson, Jackson	6 00
Best ram, 1 year old, Frank Willson, Jackson	12 00
2d do., Mrs. Ann Newton, Pontiac	8 00
3d do , Frank Willson, Jackson	5 00
Best ram lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., Frank Willson, Jackson	6 00
3d do., Frank Willson, Jackson	4 00
Best ewe, 2 years old or over, Mrs. Ann Newton, Pontiac	15 00
2d do., Frank Willson, Jackson	10 00
3d do., O. R. Rice, St. Johns	6 00
Best ewe, 1 year old, Frank Willson, Jackson	12 00
2d do., Mrs. Ann Newton, Pontiac	8 00
3d do., Frank Willson, Jackson	5 00
Best ewe lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., Frank Willson, Jackson	6 00
3d do., Frank Willson, Jackson	4 00

G. HOWARD,
E. S. DAY,
L. ANDREWS,
Judges.

CLASS 28—FAT SHEEP.

Best two middle-wooled wethers, 2 years old and under 3, Mrs. Ann Newton, Pontiac	$8 00
2d do., Jno. Moriarty, Hudson	5 00

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Best two middle-wooled wethers, 1 year old and under 2, Mrs. Ann Newton, Pontiac	$8 00
Best two long-wooled wethers, 2 years old and under 3, Frank Willson, Jackson	8 00
2d do., Mrs. Ann Newton, Pontiac	5 00
3d do., A. F. Wood, Mason	3 00
Best two long-wooled wethers, 1 year old and under 2, A. F. Wood, Mason	8 00
2d do., Frank Willson, Jackson	5 00
3d do., Frank Willson, Jackson	3 00
Best two Merino wethers, 2 years old and under 3, Frank Willson, Jackson	8 00
2d do., Mrs. Ann Newton, Pontiac	5 00

E. S. DAY,
G. HOWARD,
L. ANDREWS,
Judges.

DIVISION D—SWINE.

CLASS 39—BERKSHIRE.

Best boar, 2 years old or over, Darwin Foster, Grand Ledge	$12 00
2d do., Perry Brown, Vernon	8 00
3d do., J. W. Hibberd, Bennington	4 00
Best boar, 1 year old, B. N. Cooley, Coldwater	10 00
2d do., Bray Bros. & Loomis, St. Johns	6 00
3d do., J. W. Hibberd, Bennington	3 00
Best boar, under 1 year old, B. N. Cooley, Coldwater	8 00
2d do., B. N. Cooley, Coldwater	5 00
3d do., J. W. Hibberd, Bennington	3 00
Best brood sow, 2 years old or over, B. N. Cooley, Coldwater	12 00
2d do., J. W. Hibberd, Bennington	8 00
3d do., B. N. Cooley, Coldwater	4 00
Best sow, 1 year old, B. N. Cooley, Coldwater	10 00
2d do., B. N. Cooley, Coldwater	6 00
3d do., B. N. Cooley, Coldwater	3 00
Best sow, under 1 year old, B. N. Cooley, Coldwater	8 00
2d do., B. N. Cooley, Coldwater	5 00
3d do., J. W. Hibberd, Bennington	3 00
Best pen of pigs, not less than 4 in number, not over 6 months old, J. W. Hibberd, Bennington	8 00
2d do., Perry Brown, Vernon	5 00
3d do., Darwin Foster, Grand Ledge	3 00
Best boar, of any age, B. N. Cooley, Coldwater	Diploma

W. C. NORTON, *Judge.*

ESSEX.

Best boar, 2 years old or over, A. Chandler, Jerome	$12 00
2d do., Frank Willson, Jackson	8 00
3d do., E. T. Doney, Jackson	4 00
Best boar, 1 year old, A. Chandler, Jerome	10 00
2d do., E. T. Doney, Jackson	6 00
3d do., A. F. Wood, Mason	3 00
Best boar, under 1 year old, Frank Willson, Jackson	8 00
2d do., A. Chandler, Jerome	5 00
Best brood sow, 2 years old or over, Frank Willson, Jackson	12 00
2d do., A. Chandler, Jerome	8 00
3d do., A. F. Wood, Mason	4 00
Best sow, 1 year old, A. Chandler, Jerome	10 00
2d do., Frank Willson, Jackson	6 00
3d do., A. F. Wood, Mason	3 00
Best sow, under 1 year old, Frank Willson, Jackson	8 00
2d do., A. Chandler, Jerome	5 00
3d do., E. T. Doney, Jackson	3 00
Best pen of pigs, not less than 4 in number, nor over 6 months old, Frank Willson, Jackson	8 00
2d do., Anson Stow, Iosco	5 00
3d do., A. Chandler, Jerome	3 00

W. C. NORTON, *Judge.*

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SUFFOLK, SMALL YORKSHIRE OR VICTORIA.

Best boar, 2 years old or over, H. W. Riley, Greenville	$12 00
2d do., Frank Willson, Jackson	8 00
Best boar, 1 year old, W. M. Hilbert, North Lansing	10 00
2d do., Jno. A. Milham, Kalamazoo	6 00
3d do., S. Hilbert, North Lansing	3 00
Best boar, under 1 year old, H. W Riley, Greenville	8 00
Best brood sow, 2 years old or over, H. W. Riley, Greenville	12 00
2d do., H. W. Riley, Greenville	8 00
3d do., Frank Willson, Jackson	4 00
Best sow, 1 year old, Frank Willson, Jackson	10 00
2d do., Frank Willson, Jackson	6 00
3d do., H. W. Riley, Greenville	3 00
Best sow, under 1 year old, H. W. Riley, Greenville	8 00
2d do., H. W. Riley, Greenville	5 00
3d do., Frank Willson, Jackson	3 00
Best pen of pigs, not less 4 in number nor over 6 months old, W. M. Hilbert, North Lansing	8 00
2d do., H. W. Riley, Greenville	5 00
3d do., H. W. Riley, Greenville	3 00

W. C. NORTON, *Judge.*

POLAND-CHINA.

Best boar, 2 years old or over, E. C. Rouse, Homer	$12 00
2d do., W. S. Harris, Homer	8 00
Best boar, 1 year old, A. H. Randall, Homer	10 00
2d do., Short & Harrington, Paw Paw	6 00
3d do., L. W. & O. Barnes, Byron	3 00
Best boar, under 1 year old, W. S. Harris, Homer	8 00
2d do., W. H. Ashley, Homer	5 00
3d do., Myron Brown, Wacousta	3 00
Best brood sow, two years old and over, A. H. Randall, Homer	12 00
2d do., W. H. Ashley, Homer	8 00
3d do., A. H. Randall, Homer	4 00
Best sow, 1 year old, A. H. Randall, Homer	10 00
2d do., L. W. & O. Barnes, Byron	6 00
3d do., E. C. Rouse, Homer	3 00
Best sow under 1 year old, L. W. & O. Barnes, Byron	8 00
2d do., A. H. Randall, Homer	5 00
3d do., W. S. Harris, Homer	3 00
Best pen of pigs, not less than 4 in number, nor over 6 months old, L. W. & O. Barnes, Byron	8 00
2d do., W. S. Harris, Homer	5 00
3d do., Buck Bros., Portland	3 00
Best boar, of any age, A. H. Randall, Homer	Diploma

W. C. NORTON, *Judge.*

DUROC JERSEY.

Best boar, 2 years old or over, Quincy McBride, Burton	$12 00
Best boar, 1 year old, Quincy McBride, Burton	10 00
Best boar, under 1 year old, Quincy McBride, Burton	8 00
Best brood sow, 2 years old or over, Quincy McBride, Burton	12 00
Best sow, 1 year old, Quincy McBride, Burton	10 00
Best sow, under 1 year old, Quincy McBride, Burton	8 00
Best pen of pigs, not less than 4 in number, nor over 6 months old, Quincy McBride, Burton	8 00
Best boar, of any age, Quincy McBride, Burton	Diploma.

W. C. NORTON, *Judge.*

CHESTER AND OTHER LARGE BREEDS NOT ENUMERATED.

Best boar, 2 years old or over. C. A. Searing, Lyons	$12 00
2d do., C. A. Searing, Lyons	8 00
3d do., Henry Mitton, Ridgetown, Ont.	4 00

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Best boar, 1 year old, C. A. Searing, Lyons	$10 00
2d do., Frank Kaley, Portland	6 00
3d do., Frank Kaley, Portland	3 00
Best boar, under 1 year old, C. A. Searing, Lyons	8 00
2d do., C. A. Searing, Lyons	5 00
3d do., C. A. Searing, Lyons	3 00
Best brood sow, 2 years old or over, C. A. Searing, Lyons	12 00
2d do., Henry Mitton, Ridgetown, Ont.	8 00
3d do., Frank Kaley, Portland	4 00
Best sow, 1 year old, C. A. Searing, Lyons	10 00
2d do., C. A. Searing, Lyons	6 00
3d do., Frank Kaley, Portland	3 00
Best sow, under 1 year old, C. A. Searing, Lyons	8 00
2d do., C. A. Searing, Lyons	5 00
3d do., C. A. Searing, Lyons	3 00
Best pen of pigs, not less than 4 in number, nor over 6 months old, C. A. Searing, Lyons	8 00
2d do., C. A. Searing, Lyons	5 00
3d do., Frank Kaley, Portland	3 00
Best boar, of any age, C. A. Searing, Lyons	Diploma.

W. C. NORTON, *Judge.*

FAT HOGS.

Best barrow, over 1 year old, H. W. Riley, Greenville	$10 00
2d do., Frank Willson, Jackson	6 00
3d do., Robt. Brooks, Portland	3 00
Best barrow, less than 10 months old, Frank Willson, Jackson	6 00

W. C. NORTON, *Judge.*

DIVISION E.

CLASS 30—POULTRY.

Best pair Light Brahma fowls, Jas. Ball, Marshall	$1 50
Best pair Light Brahma chicks, Jas. Ball, Marshall	1 50
Best pair Dark Brahma fowls, C. L. Hogue, Battle Creek	1 50
2d do., Jas. Ball, Marshall	1 00
Best pair Dark Brahma chicks, Jas. Ball, Marshall	1 50
2d do., C. L. Hogue, Battle Creek	1 00
Best pair Buff Cochin fowls, A. E. Vosburgh, Battle Creek	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Buff Cochin chicks, A. E. Vosburgh, Battle Creek	1 50
2d do., A. E. Vosburgh, Battle Creek	1 00
Best pair Partridge Cochin fowls, Jas. Ball, Marshall	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Partridge Cochin chicks, Jas. Ball, Marshall	1 50
2d do., Jas. Ball, Marshall	1 00
Best pair White Cochin fowls, Jas. Ball, Marshall	1 50
2d do., Eugene J. Kirby, Marshall	1 00
Best pair White Cochin chicks, Eugene J. Kirby, Marshall	1 50
2d do , Jas. Ball, Marshall	1 00
Best pair Black Cochin fowls, Jas. Ball, Marshall	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Black Cochin chicks, Jas. Ball, Marshall	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Langshan fowls, Oldfield & Bingham, Cedar Springs	1 50
2d do., Jas Ball, Marshall	1 00
Best pair Langshan chicks, Jas. Ball, Marshall	1 50
2d do., Oldfield & Bingham, Cedar Springs	1 00
Best pair Plymouth Rock fowls, C. L. Hogue, Battle Creek	1 50
2d do., Jas. Ball, Marshall	1 00
Best pair Plymouth Rock chicks, Jas. Ball, Marshall	1 50
2d do., C. L. Hogue, Battle Creek	1 00
Best pair White Plymouth Rock chicks, Eugene J. Kirby, Marshall	1 50

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Best pair Laced Wyandotte fowls, C. L. Hogue, Battle Creek	$1 50
2d do., C. L. Hogue, Battle Creek	1 00
Best pair Laced Wyandotte chicks, C. L. Hogue, Battle Creek	1 50
2d do., Oldfield & Bingham, Cedar Springs	1 00
Best pair White Wyandotte fowls, C. L. Hogue, Battle Creek	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair White Wyandotte chicks, Eugene J. Kirby, Marshall	1 50
2d do., Jas. Ball, Marshall	1 00
Best pair Golden Wyandotte fowls, C. L. Hogue, Battle Creek	1 50
Best pair Golden Wyandotte chicks, C. L. Hogue, Battle Creek	1 50
2d do., C. L. Hogue, Battle Creek	1 00
Best pair Dominique fowls, Jas. Ball, Marshall	1 50
Best pair Dominique chicks, Jas. Ball, Marshall	1 50
Best pair Black Breasted Red Game Bantam fowls, Mrs. G. H. Potter, Lansing	1 50
2d do., Oldfield & Bingham, Cedar Springs	1 00
Best pair Black Breasted Red Game Bantam chicks, C. L. Hogue, Battle Creek	1 50
2d do., Oldfield & Bingham, Cedar Springs	1 00
Best pair Brown Red Game Bantam chicks, Mrs. G. H. Potter, Lansing	1 50
Best pair Yellow Duckwing Bantam fowls, D. R. McElwain & Co., Hastings	1 50
Best pair Yellow Duckwing Bantam chicks, D. R. McElwain & Co., Hastings	1 50
Best pair Silver Duckwing Bantam fowls, Mrs. G. H. Potter, Lansing	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Silver Duckwing Bantam chicks, Mrs. G. H. Potter, Lansing	1 50
2d do., Mrs. G. H. Potter, Lansing	1 00
Best pair Red Pile Bantam fowls, D. R. McElwain & Co., Hastings	1 50
Best pair Red Pile Bantam chicks, D. R. McElwain & Co., Hastings	1 50
Best pair White Pile Bantam chicks, D. R. McElwain & Co., Hastings	1 50
Best pair Golden Seabright Bantam fowls, Wesley Turner, Lansing	1 50
Best pair Golden Seabright Bantam chicks, Wesley Turner, Lansing	1 50
Best pair Japanese Bantam fowls, Eugene J. Kirby, Marshall	1 50
Best pair Black Bantam fowls, Oldfield & Bingham, Cedar Springs	1 50
2d do., James Ball, Marshall	1 00
Best pair Black Bantam chicks, Oldfield & Bingham, Cedar Springs	1 50
2d do., Oldfield & Bingham, Cedar Springs	1 00
Best pair Colored Dorking fowls, A. E. Vosburgh, Battle Creek	1 50
Best pair Colored Dorking chicks, A. E. Vosburgh, Battle Creek	1 50
Best pair Silver-Gray Dorking fowls, Jas. Ball, Marshall	1 50
2d do., A. E. Vosburgh, Battle Creek	1 00
Best pair White Dorking chicks, Eugene J. Kirby, Marshall	1 50
Best pair Black Breasted Red Game fowls, D. R. McElwain & Co., Hastings	1 50
2d do., Mrs. G. H. Potter, Lansing	1 00
Best pair Black Breasted Red Game chicks, D. R. McElwain & Co., Hastings	1 50
Best pair Brown Breasted Red Game fowls, Mrs. G. H. Potter, Lansing	1 50
Best pair Brown Breasted Red Game chicks, D. R. McElwain & Co., Hastings	1 50
Best pair Red Pile Game fowls, Mrs. G. H. Potter, Lansing	1 50
Best pair Red Pile Game chicks, Ambrose Purchase, Freeland	1 50
Best pair White Pile Game chicks, D. R McElwain & Co., Hastings	1 50
2d do., Ambrose Purchase, Freeland	1 00
Best pair White Game chicks, Mrs. G. H. Potter, Lansing	1 50
Best pair Silver Spangled Hamburg fowls, D. R. McElwain & Co., Hastings	1 50
2d do., Nelson Davidson, Lansing	1 00
Best pair Silver Spangled Hamburg chicks, Nelson Davidson, Lansing	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Golden Penciled Hamburg fowls, D. R. McElwain & Co., Hastings	1 50
Best pair Silver Penciled Hamburg fowls, D. R. McElwain & Co., Hastings	1 50
Best pair Black Hamburg fowls, D. R. McElwain & Co., Hastings	1 50
2d do., Ambrose Purchase, Freeland	1 00
Best pair White Hamburg fowls, D. R. McElwain & Co., Hastings	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair White Crested Black Polish fowls, Jas. Ball, Marshall	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair White Crested Black Polish chicks, D. R. McElwain & Co., Hastings	1 50
2d do., Jas. Ball, Marshall	1 00
Best pair White Polish fowls, Ambrose Purchase, Freeland	1 50
2d do., A. E. Vosburg, Battle Creek	1 00
Best pair White Polish chicks, Ambrose Purchase, Freeland	1 50

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Best pair White Polish Bearded fowls, D. R. McElwain & Co., Hastings	$1 50
Best pair Golden Polish Chicks, Ambrose Purchase, Freeland	1 50
2d do., Ambrose Purchase, Freeland	1 00
Best pair Golden Polish Bearded fowls, A. E. Vosburgh, Battle Creek	1 50
Best pair Golden Polish Bearded chicks, A. E. Vosburgh, Battle Creek	1 50
2d do., Ambrose Purchase, Freeland	1 00
Best pair Silver Polish fowls, Ambrose Purchase, Freeland	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Silver Polish chicks, Ambrose Purchase, Freeland	1 50
Best pair Silver Polish Bearded fowls, Jas. Ball, Marshall	1 50
2d do., A. E. Vosburg, Battle Creek	1 00
Best pair Silver Polish Bearded chicks, Jas. Ball, Marshall	1 50
2d do., A. E. Vosburg, Battle Creek	1 00
Best pair Black Spanish fowls, Oldfield & Bingham, Cedar Springs	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Black Spanish chicks, Oldfield & Bingham, Cedar Springs	1 50
2d do., Oldfield & Bingham, Cedar Springs	1 00
Best pair Single Comb White Leghorn fowls, Oldfield & Bingham, Cedar Springs	1 50
2d do., Oldham & Bingham, Cedar Springs	1 00
Best pair Single Comb White Leghorn chicks, Oldfield & Bingham, Cedar Springs	1 50
2d do., Nelson Davidson, Lansing	1 00
Best pair Single Comb Brown Leghorn fowls, Oldfield & Bingham, Cedar Springs	1 50
2d do., Ambrose Purchase, Freeland	1 00
Best pair Single Comb Brown Leghorn chicks, Oldfield & Bingham, Cedar Springs	1 50
2d do., Geo. Bender, Onondaga	1 00
Best pair Black Leghorn fowls, D. R. McElwain & Co., Hastings	1 50
Best pair Black Leghorn chicks, D. R. McElwain & Co., Hastings	1 50
Best pair Rose Comb Brown Leghorn fowls, Oldfield & Bingham, Cedar Springs	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Rose Comb Brown Leghorn chicks, Oldfield & Bingham, Cedar Springs	1 50
2d do., Oldfield & Bingham, Cedar Springs	1 00
Best pair Dominique Leghorn fowls, D. R. McElwain & Co , Hastings	1 50
Best pair White Minorca fowls, Eugene J. Kirby, Marshall	1 50
Best pair Black Minorca fowls, Jas. Ball, Marshall	1 50
Best pair Black Minorca chicks, Jas Ball, Marshall	1 50
2d do., Oldfield & Bingham, Cedar Springs	1 00
Best pair Pekin ducks, Jas. Ball, Marshall	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Rouen ducks, D. R. McElwain & Co., Hastings	1 50
2d do., Jas. Ball, Marshall	1 00
Best pair Aylesbury ducks, D. R. McElwain & Co., Hastings	1 50
2d do., Geo. H. Olds, York	1 00
Best pair Cayuga ducks, D. R. McElwain & Co., Hastings	1 50
2d do., Ambrose Purchase, Freeland	1 00
Best pair White Call ducks, D. R. McElwain & Co., Hastings	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Colored Muscovy ducks, Ambrose Purchase, Freeland	1 50
Best pair Crested White ducks, Ambrose Purchase, Freeland	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Toulouse geese, Geo. H. Olds, York	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Embden geese, Geo. H. Olds, York	1 50
Best pair White China geese, Ambrose Purchase, Freeland	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair Brown China geese, Geo. H. Olds, York	1 50
2d do., D. R. McElwain & Co., Hastings	1 00
Best pair African geese, Ambrose Purchase, Freeland	1 50
2d do., Ambrose Purchase, Freeland	1 00
Best pair Bronze turkeys, Geo. H. Olds, York	1 50
2d do., Ambrose Purchase, Freeland	1 00

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Best pair White turkeys, D. R. McElwain & Co., Hastings	$1 50
2d do , Ambrose Purchase, Freeland	1 00
Best pair Black turkeys, D. R. McElwain & Co., Hastings	1 50
Best pair Slate turkeys, Ambrose Purchase, Freeland	1 50
Best pair peafowls, Ambrose Purchase, Freeland	1 50
Best pair Pearl Guinea fowls, D. R. McElwain & Co., Hastings	1 50
2d do., Ambrose Purchase, Freeland	1 00
Best pair White Guinea fowls, Ambrose Purchase, Freeland	1 50
2d do., D. R. McElwain & Co., Hastings	1 00

D. M. CHRISTY,
L. R. FREEMAN,
Judges.

DIVISION F.

CLASS 31—FARM AND GARDEN PRODUCE AND MANUFACTURED PRODUCTS.

Best bushel red wheat, A. W. Jewett, Mason	$2 00
2d do., Wm. A. Melton, Mason	1 00
Best bushel white wheat, A. W. Jewett, Mason	2 00
2d do., Buck Bros., Portland	1 00
Best bushel white oats, M. J. Howe, Waterloo	2 00
2d do., A W. Jewett, Mason	1 00
Best bushel black oats, A. W. Jewett, Mason	2 00
Best bushel yellow oats, A. W. Jewett, Mason	2 00
2d do., C. A. Darling, River Bend	1 00
Best 12 ears yellow dent corn, Thos. H. McCurdy, Lansing	1 50
Best 12 ears white dent corn, Jacob T. Timpe, Grand Ledge	1 50
2d do., A. W. Jewett, Mason	1 00
Best 12 ears yellow flint corn, 8 rowed, A. W. Jewett, Mason	1 50
2d do., Nelson Davidson, Lansing	1 00
Best 12 ears red flint corn, blazed, A. W. Jewett, Mason	1 50
Best 12 ears white flint corn, 8 rowed, Nelson Davidson, Lansing	1 50
2d do., Jacob T. Timpe, Grand Ledge	1 00
Best 12 ears sweet corn, early, Darwin Foster, Grand Ledge	1 50
2d do., R. Mann & Son, Lansing	1 00
Best 12 ears sweet corn, late, Wm. F. Miller, Mason	1 50
2d do., B. E. Ballard, Lansing	1 00
Best 12 ears pop corn, Jacob T. Timpe, Grand Ledge	1 50
2d do., Mabel E. Markey, North Lansing	1 00
Best bushel rye, A. W. Jewett, Mason	2 00
2d do., Frank McGuffie, Leslie	1 00
Best bushel four-rowed barley, Philip Beal, Lansing	2 00
2d do., Myron Brown, Wacousta	1 00
Best bushel timothy seed, A. W. Jewett, Mason	2 00
2d do., C. A. Darling, River Bend	1 00
Best bushel buckwheat, A. W. Jewett, Mason	2 00
2d do., O. C. Wheeler, Lansing	1 00
Best bushel flax seed, A. W. Jewett, Mason	2 00
Best bushel red top grass seed, A. W. Jewett, Mason	2 00
Best bushel blue grass seed, A. W. Jewett, Mason	2 00
Best bushel Hungarian grass seed, A. W. Jewett, Mason	2 00
2d do., C. A. Darling, River Bend	1 00
Best bushel millet, C. A. Darling, River Bend	2 00
2d do., A. W. Jewett, Mason	1 00
Best bushel pease, C. A. Darling, River Bend	2 00
2d do., Frank McGuffie, Leslie	1 00
Best bushel white beans, Chas. Wildt, North Lansing	2 00
2d do., A. W. Jewett, Mason	1 00
Best display of a general assortment of seeds for field crops, A. W. Jewett, Mason	10 00
2d do., D. Woodman, Paw Paw	5 00
Best display of grains in heads, A. W. Jewett, Mason	10 00
2d do., D. Woodman, Paw Paw	5 00
Best display and collection of corn in the ear, to consist of at least 12 ears of each variety shown, A. W. Jewett, Mason	10 00

T. DENSMERE, *Judge.*

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CLASS 32—ROOTS AND VEGETABLES.

Best peck Early Sunrise potatoes, Chas. Witters, Mason	$1 50
2d do., Wm. F. Miller, Mason	1 00
Best peck Early Vermont potatoes, A. W. Jewett, Mason	1 50
2d do., Wm. F. Miller, Mason	1 00
Best peck Early Ohio potatoes, A. W. Jewett, Mason	1 50
2d do., Thos. H. McCurdy, Lansing	1 00
Best peck Early Beauty of Hebron potatoes, A. W. Jewett, Mason	1 50
2d do., Nelson Davidson, Lansing	1 00
Best peck Ontario potatoes, A. W. Jewett, Mason	1 50
2d do., Wm. F. Miller, Mason	1 00
Best peck Late Rose potatoes, Chas. Witters, Mason	1 50
2d do., Wm. F. Miller, Mason	1 00
Best peck White Elephant potatoes, Wm. F. Miller, Mason	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck Granger potatoes, A. W. Jewett, Mason	1 50
Best peck Barbank potatoes, A. W. Jewett, Mason	1 50
2d do., Wm. F. Miller, Mason	1 00
Best peck Mammoth Pearl potatoes, A. W. Jewett, Mason	1 50
2d do., Jacob T. Timpe, Grand Ledge	1 00
Best peck White Star potatoes, A. W. Jewett, Mason	1 50
2d do., Chas. Witters, Mason	1 00
Best peck Belle potatoes, A. W. Jewett, Mason	1 50
2d do., Thos. H. McCurdy, Lansing	1 00
Best peck Late Beauty of Hebron potatoes, A. W. Jewett, Mason	1 50
2d do., Wm. F. Miller, Mason	1 00
Best peck Snowflake potatoes, A. W. Jewett, Mason	1 50
2d do., Chas. Witters, Mason	1 00
Best 6 blood beets, Wm. F. Miller, Mason	1 50
2d do., Frank Willson, Jackson	1 00
Best 6 turnip beets, Wm. F. Miller, Mason	1 50
2d do., Frank Willson, Jackson	1 00
Best 6 sugar beets, Geo. Horton, Jackson	1 50
2d do., Wm. F. Miller, Mason	1 00
Best 6 white or yellow beets, Chas. Witters, Mason	1 50
2d do., Wm. F. Miller, Mason	1 00
Best 6 beets for table use, Geo. Horton, Jackson	1 50
2d do., Wm. F. Miller, Mason	1 00
Best 6 mangel wurzels, Chas. Witters, Mason	1 50
2d do., Wm. F. Miller, Mason	1 00
Best 6 orange carrots, Geo. Horton, Jackson	1 50
2d do., Jacob T. Timpe, Grand Ledge	1 00
Best 6 white carrots, Wm. F. Miller, Mason	1 50
2d do., Chas. Witters, Mason	1 00
Best 6 any other variety of carrots, Geo. Horton, Jackson	1 50
2d do., Wm. F. Miller, Mason	1 00
Best 6 flat turnips, Wm. F. Miller, Mason	1 50
2d do., Chas. Witters, Mason	1 00
Best 6 Swede turnips, Wm. F. Miller, Mason	1 50
2d do., Chas. Witters, Mason	1 00
Best 6 any other variety of turnips, Thos. H. McCurdy, Lansing	1 50
2d do., Thos. H. McCurdy, Lansing	1 00
Best 6 parsnips, Geo. Horton, Jackson	1 50
2d do., Chas. Witters, Mason	1 00
Best 6 salsify, M. Wetterling, Ionia	1 50
2d do., Jacob T. Timpe, Grand Ledge	1 00
Best 6 winter radishes, Wm. F. Miller, Mason	1 50
2d do., Chas. Witters, Mason	1 00
Best 6 summer radishes, Chas. Witters, Mason	1 50
Best 4 heads drumhead cabbage, Wm. F. Miller, Mason	1 50
2d do., Chas. Witters, Mason	1 00
Best 4 heads conehead cabbage, Chas. Witters, Mason	1 50
2d do., Wm. F. Miller, Mason	1 00
Best 4 heads red cabbage, Chas. Witters, Mason	1 50
2d do., W. E. West, Lansing	1 00

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Best 4 heads cauliflower, Geo. Horton, Jackson	$1 50
2d do., Jacob T. Timpe, Grand Ledge	1 00
Best 6 heads lettuce, Chas. Witters, Mason	1 50
2d do., A. W. Jewett, Mason	1 00
Best 6 bunches kale, Chas. Witters, Mason	1 50
Best 12 stems celery, bleached, Geo. Horton, Jackson	1 50
2d do., M. Wetterling, Ionia	1 00
Best 12 stems rhubarb, W. E. West, Lansing	1 50
2d do., Frank McGuffie, Leslie	1 00
Best ½ dozen vegetable eggs, Geo. Horton, Jackson	1 00
Best dozen peppers, Geo. Horton, Jackson	1 50
Best 8 varieties of tomatoes, 1 dozen of each, S. E. Oviatt, Lansing	1 50
2d do., Chas. Witters, Mason	1 00
Best peck any variety tomatoes, S. E. Oviatt, Lansing	1 50
2d do., Wm. F. Miller, Mason	1 00
Best peck white onions, A. W. Jewett, Mason	1 50
2d do., W. F. Miller, Mason	1 00
Best peck red onions, Geo. Horton, Jackson	1 50
2d do., Wm. F. Miller, Mason	1 00
Best peck yellow onions, George Horton, Jackson	1 50
2d do., Wm. F. Miller, Mason	1 00
Best 5 summer squashes, A. W. Jewett, Mason	1 50
2d do., Geo. Horton, Jackson	1 00
Best 2 sweet pumpkins, A. W. Jewett, Mason	1 50
Best 3 water melons, Chas. Witters, Mason	1 50
Best 3 nutmeg melons, Geo. Horton, Jackson	1 50
2d do., A. B. Gregory & Son, North Lansing	1 00
Best 3 citrons, Geo. Horton, Jackson	1 50
Best 5 cucumbers, Chas. Witters, Mason	1 50
2d do., Thos. H. McCurdy, Lansing	1 00
Best ½ peck garden peas, Wm. F. Miller, Mason	1 50
Best ½ peck bush beans, W. E. West, Lansing	1 50
2d do., Abner Brown, Lansing	1 00
Best ½ peck wax beans, Wm. F. Miller, Mason	1 50
2d do., A. W. Jewett, Mason	1 00
Best 6 heads sunflower, Frank McGuffie, Leslie	1 50
2d do., Nelson Davidson, Lansing	1 00
Best 6 stems Swiss chard, Chas. Witters, Mason	1 50
2d do., Geo. Horton, Jackson	1 00
Best 6 stems parsley, Geo. Horton, Jackson	1 50
2d do., Jacob T. Timpe, Grand Ledge	1 00
Best 6 stems spinach, Geo. Horton, Jackson	1 50
Best 6 stems any sweet or pot herb, A. W. Jewett, Mason	1 50
2d do., Jacob T. Timpe, Grand Ledge	1 00
Best 6 stems kohl rabi, Chas. Witters, Mason	1 50

PROF. L. R. TAFT, *Judge.*

CLASS 33—DISPLAY OF ROOTS AND VEGETABLES.

Best display of roots and vegetables by a professional gardener, Chas. J. Miller, Mason	$40 00
2d do., Davis Bros., Jackson	30 00
Best display of potatoes, not less than 40 varieties, 6 specimens of each variety, A. W. Jewett, Mason	25 00
2d do., Wm. F. Miller, Mason	15 00

PROF. L. R. TAFT, *Judge.*

CLASS 34—FLOUR, MEAL AND FEED.

Best barrel flour, made from white wheat, McClure & Egbert, Charlotte	$3 00
2d do., A. N. Hart, Lansing	2 00
Best barrel flour made from red wheat, McClure & Egbert, Charlotte	3 00
Best bolted meal, 50-pound sack, McClure & Egbert, Charlotte	2 00
Best corn meal, 50-pound sack, McClure & Egbert, Charlotte	2 00

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Best ground feed, 50-pound sack, McClure & Egbert, Charlotte..... $2 00
Best buckwheat flour, 50-pound sack, McClure & Egbert, Charlotte..... 2 00
Best graham flour, 50-pound sack, McClure & Egbert, Charlotte..... 2 00

T. DENSMERE, *Judge.*

NOT ENUMERATED.

Male figure representing "Corn is King," D. Woodman, Paw Paw..... $5 00
Female figure representing "Ceres," D. Woodman, Paw Paw..... 5 00
Display of grasses, arranged and named, D. Woodman, Paw Paw..... 5 00

T. DENSMERE, *Judge.*

DIVISION G—DAIRY AND OTHER PRODUCTS.

CLASS 35—BUTTER, CHEESE AND DAIRY ARTICLES.

Best 15 pounds domestic butter, made at any time, Mrs. C. N. Holkins, Jonesville..... $10 00
2d do., Mrs. Willard King, Lansing..... 8 00
3d do., Mrs. O. R. Rice, St. Johns..... 5 00
Best 25 pounds creamery butter, made at any time, Quincy McBride, Burton.. 8 00
Best 5 pounds print butter, Mrs. C. N. Holkins, Jonesville..... 4 00
Best display of cheese by any factory, Robt. McKinney, Wixom..... 15 00
2d do., N. G. Watson, Grand Ledge..... 10 00

FRANKLIN WELLS,
M. J. GARD,
Judges.

CLASS 36—SUGAR, BREAD AND PICKLES.

Best 10 pounds maple sugar, E. C. Cole, Addison..... $5 00
2d do., D. L. Garver, Hart..... 3 00
Best gallon maple syrup, D. L. Garver, Hart..... 3 00
2d do., J. K. Moss, Grand Ledge..... 2 00
Best 2 loaves baker's bread, J. L. Peterman, Jackson..... 3 00
Best 2 loaves milk or salt rising bread, Mrs. M. E. Bartlett, Tompkins Center.. 3 00
2d do., Mrs. Geo. H. Potter, Lansing..... 2 00
Best 2 loaves yeast bread, Mrs. A. F. Wood, Mason..... 3 00
2d do., Mrs. M. E. Bartlett, Tompkins Center..... 1 00
Best corn bread, Mrs. A. S. Thompson, Lansing..... 3 00
2d do., Mrs. M. E. Bartlett, Tompkins Center..... 2 00
Best 2 loaves brown bread, B. F. King, Lansing..... 3 00
2d do., Mrs. M. E. Bartlett, Tomkpins Center..... 2 00
Best 2 loaves rye bread, Mrs. M. E. Bartlett, Tompkins Center..... 2 00
Best display of specimens of pickled vegetables, Davis Bros., Jackson..... 5 00
2d do, Mrs. M. E. Bartlett, Tompkins Center..... 3 00

MRS. S. H. PRESTON,
MRS. E. A. McKIBBIN,
Judges.

Special.

Best 5 pound batch Jersey butter made in the State, O. J. Bliss, Silver Creek, gold medal.

FRANKLIN WELLS,
M. J. GARD,
Judges.

Not Enumerated.

Best display of crackers and sweet goods, J. R. & W. S. Esselstyn, Lansing.. $2 00
Best 2 loaves oatmeal bread, Cereal Milling Co., Chicago..... 2 00

MRS. S. H. PRESTON,
MRS. E. A. McKIBBIN,
Judges.

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DIVISION H.

CLASS 38—BEES, HONEY, AND APIARIAN IMPLEMENTS.

Best nuclei colony black bees, H. D. Cutting, Clinton	$5 00
2d do., W. Z Hutchinson, Flint	3 00
Best nuclei colony Italian bees, Jacob T. Timpe, Grand Ledge	5 00
2d do., W. Z. Hutchinson, Flint	3 00
Best nuclei colony Syrian bees, H. D. Cutting, Clinton	5 00
2d do., W. Z Hutchinson, Flint	3 00
Best nuclei colony Carnialan bees, H. D. Cutting, Clinton	5 00
2d do , W. Z. Hutchinson, Flint	3 00
Best nuclei colony Albino bees, H. D. Cutting, Clinton	5 00
2d do., W. Z. Hutchinson, Flint	3 00
Best display of the different races of bees, W. Z. Hutchinson, Flint	5 00
2d do., H. D. Cutting, Clinton	3 00
Best specimen of comb honey, not less than 20 pounds, H. D. Cutting, Clinton	10 00
2d do., W. A. Barnes, De Witt	5 00
Best display comb honey, W. Z. Hutchinson, Flint	20 00
2d do , H. D. Cutting, Clinton	10 00
Best display comb honey, by a lady, the product of her own apiary, Miss R. Cutting, Clinton	10 00
2d do., May Hutchinson, Flint	5 00
Best specimen of extracted honey, not less than 20 pounds, Miss Anna R. Cutting, Clinton	10 00
2d do , H. D. Cutting, Clinton	5 00
Best display of extracted honey, H. D. Cutting, Clinton	20 00
2d do., Miss Anna R. Cutting, Clinton	10 00
Best beeswax, specimen not less than 10 pounds, A. B. Gregory & Son, North Lansing	2 00
2d do., W. Z. Hutchinson, Flint	1 00
Best comb foundation, made on the grounds, H. D. Cutting, Clinton	2 00
Best comb foundation, specimen, W. Z. Hutchinson, Flint	2 00
2d do., H. D. Cutting, Clinton	1 00
Largest, best, most interesting and instructive exhibition in this department, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Flint	6 00

A. B. MASON, *Judge.*

DIVISION L—MANUFACTURED GOODS.

CLASS 48—MATERIALS.

Best display of fine wool, not less than 10 samples, grown by exhibitor, Amos Parmenter, Vernon	$5 00
Best display of long wool, not less than 10 samples, grown by exhibitor, Frank Willson, Jackson	5 00
2d do., A. F. Wood, Mason	3 00
Best display of middle wool, not less than 10 samples, grown by exhibitor, Frank Willson, Jackson	5 00

S. L. WISE,
CHAS. S. HATHAWAY,
A. J. BROW,
Judges.

CLASS 49—FACTORY MADE.

Best display of carpeting, rugs and window curtains, Burnham & Co., Lansing	$10 00

S. L. WISE,
CHAS. S. HATHAWAY,
A. J. BROW,
Judges.

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CLASS 51—ARTICLES OF LEATHER AND INDIA RUBBER.

Best display of trunks, not less than 10 in number, Chas. Brodhagen, Lansing.	$10 00
Best double carriage harness, manufactured in the State, Chas. Brodhagen Lansing	3 00
Best single buggy harness, manufactured in the State, Charles Brodhagen, Lansing	3 00
Best double harness for farm, manufactured in the State, Chas. Brodhagen, Lansing	3 00

A. J. BROW,
CHAS. S. HATHAWAY,
S. L. WISE,
Judges.

CLASS 52—ARTICLES OF FURNITURE.

Best display of furniture of all kinds, M. J. Buck, Lansing	$25 00
Best set of chamber furniture, not less than 3 pieces, M. J. Buck, Lansing	10 00
Best set of dining room chairs, M. J. Buck, Lansing	3 00
Best book case, M. J. Buck, Lansing	3 00
Best center table, M. J. Buck, Lansing	3 00
2d do., W. A. Neff, Lansing	2 00
Best dressing bureau, M. J. Buck, Lansing	3 00
Best desk of any kind, M. J. Buck. Lansing	3 00
Best easy chair, M. J. Buck, Lansing	3 00
2d do., Fred Boyer, Grand Ledge	2 00
Best extension table, M. J. Buck, Lansing	3 00
Best hall tree hat rack, M. J. Buck, Lansing	2 00
Best lounge or couch, M. J. Buck, Lansing	3 00
Best library table, M. J. Buck, Lansing	3 00
Best parlor writing desk, M. J. Buck, Lansing	3 00
Best pier mirror and base, M. J. Buck, Lansing	5 00
Best sofa, M. J. Buck, Lansing	3 00
Best sideboard, M. J. Buck, Lansing	3 00
Best upholstered reception chair, M. J. Buck, Lansing	3 00
Best display of willow or rattan chairs, M. J. Buck, Lansing	2 00

A. J. BROW,
CHAS. S. HATHAWAY,
S. L. WISE,
Judges.

CLASS 53—STOVES, IRON AND ORNAMENTAL CONCRETE WORK.

Best rustic work (display), B. F. Simons, Lansing	$2 00

A. J. BROW,
CHAS. S. HATHAWAY,
S. L. WISE,
Judges.

NOT ENUMERATED.

Best display show-cases, Jacob Tron, Lansing	$3 00

A. J. BROW,
CHAS. S. HATHAWAY,
S. L. WISE,
Judges.

DIVISION M—MUSICAL INSTRUMENTS, SEWING MACHINES, OPTICAL GOODS, ETC.

CLASS 56—CLOCKS, JEWELRY, PLATED-WARE, CUTLERY, ETC.

Best exhibition of silver-plated ware, R. E. Brackett & Son, Lansing	$3 00
Best exhibition of table cutlery, R. E. Brackett & Son, Lansing	2 00
Best display of American watches, R. E. Brackett & Son, Lansing	2 00
Best exhibition of Britannia ware, R. E. Brackett & Son, Lansing	2 00

M. P. ANDERSON, *Judge.*

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DIVISION N—PAINTING, SCULPTURE, ETC.

Best collection of oil paintings, not less than 125 in number, A. J. Brow, Detroit	$200 00
Best collection of water colors, not less than 25 in number, A. J. Brow, Detroit	25 00
Best historical painting, in oil, shown by any person, A. J. Brow, Detroit	20 00
2d do., A. J. Brow, Detroit	10 00
Best landscape painting, in oil, shown by any person, A. J. Brow, Detroit	10 00
2d do., A. J. Brow, Detroit	5 00
Best landscape painting, in oil, of scenery in Michigan, A. J. Brow, Detroit	10 00
2d do., A. J. Brow, Detroit	5 00
Best landscape painting, in water colors, of scenery in Michigan, A. J. Brow, Detroit	8 00
2d do., A. J. Brow, Detroit	5 00
Best marine painting, in oil, shown by any person, A. J. Brow, Detroit	10 00
2d do., A. J. Brow, Detroit	5 00
Best portrait, in oil, shown by any person, A. J. Brow, Detroit	10 00
2d do., A. J. Brow, Detroit	5 00
Best pastel painting of landscape, A. J. Brow, Detroit	5 00
2d do , A. J. Brow, Detroit	3 00
Best special subject, in oil, shown by any person, A. J. Brow, Detroit	5 00
2d do., Martha Buck, Lansing	3 00
Best special subject, in water colors, shown by any person, A. J. Brow, Detroit	5 00
2d do., A. J. Brow, Detroit	3 00
Best winter piece, in oil, shown by any person, A. J. Brow, Detroit	10 00
2d do., A. J. Brow, Detroit	5 00
Best display of gilt frames, A. J. Brow, Detroit	5 00
Best display of picture frames, in bronze or wood, A. J. Brow, Detroit	5 00
Best collection of photographs, by any person, not less than 20 in number, Charlotte Lewis, Lansing	5 00
Best landscape photograph, Mrs. E. C. Chapin, Lansing	2 00
Best animal piece, from life, in oil, done by exhibitor, W. H. Machen, Detroit	10 00
2d do., Helen M. Peck, Allegan	5 00
Best bird piece, in oil, done by exhibitor, W. H. Machen, Detroit	5 00
2d do., Helen M. Peck, Allegan	3 00
Best composition landscape, in oil, by exhibitor, H. S. Bullock, Detroit	5 00
2d do., Robt. Hopkins, Detroit	3 00
Best collection of oil paintings, not less than 5 in number, done by exhibitor, Robt. Hopkins, Detroit	10 00
2d do., H. S. Bullock, Detroit	5 00
Best collection of water color paintings, not less than 5 in number, done by exhibitor, Robt. Hopkins, Detroit	5 00
2d do., H. S. Bullock, Detroit	3 00
Best fruit piece in oil, done by exhibitor, W. B. Conley, Detroit	5 00
2d do., Mrs. P. Clements Tabor, Grand Rapids	3 00
Best fancy fancy painting in oil, done by exhibitor, Grace W. Ford, Jackson	5 00
2d do , Mrs. E. F. Woodcock, Lansing	3 00
Best fancy painting in water colors, by exhibitor, Robt. Hopkins, Detroit	5 00
Best historical painting in oil, by exhibitor, H. S. Bullock, Detroit	10 00
2d do., Miss A. Thoman, Lansing	5 00
Best landscape from nature, in oil, by exhibitor, Robt. Hopkins, Detroit	10 00
2d do., F. H. Hayward, Mt. Clemens	5 00
Best landscape in water colors, by exhibitor, H. S. Bullock, Detroit	10 00
2d do., Robt. Hopkins, Detroit	5 00
Best marine scene in oil, by exhibitor, Robt. Hopkins, Detroit	10 00
2d do., Robt. Hopkins, Detroit	5 00
Best portrait from life, large size, in oil, by exhibitor, John B. Potter, Lansing	10 00
2d do., W. B. Conley, Detroit	5 00
Best portrait from life, cabinet size, in oil, by exhibitor, Charlotte Lewis, Lansing	5 00
Best portrait painting in pastel, by exhibitor, Mrs. Sarah A. Mott, Coldwater	5 00
Best pastel painting in water colors, by exhibitor, John B. Potter, Lansing	5 00
2d do., Ellen Geer, Eaton Rapids	3 00

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Best winter piece in oil, by exhibitor, H. S. Bullock, Detroit	$5 00
2d do., Robt. Hopkins, Detroit	3 00
Best crayon portrait, by exhibitor, F. H. Hayward, Mt. Clemens	5 00
2nd do., Miss Florence Waterman, Detroit	3 00

L. D. WATKINS,
S. L. WISE,
CHAS. S. HATHAWAY,
Judges.

CLASS 58—PAINTING AND DRAWING (BY AMATEUR ARTISTS).

Best bird piece in oil, by exhibitor, Mrs. E. F. Woodcock, Lansing	$3 00
2d do., Alexander Hahn, Lansing	2 00
Best composition landscape in oil, by exhibitor, Kittie L. Holbrook, Lansing	3 00
2d do., Mrs. Sarah A. Mott, Coldwater	2 00
Best collection of oil paintings, not less than 5 in number, by exhibitor, F. H. Hayward, Mt. Clemens	3 00
2d do., Martha Buck, Lansing	2 00
Best collection of water color paintings, not less than five in number, by exhibitor, Mrs. Sarah A. Mott, Coldwater	3 00
Best display of decorated porcelain, not less than 25 pieces, by exhibitor, Mrs. R. A. Montgomery, Lansing	10 00
2d do., W. A. Johnson, Lansing	5 00
Best fruit piece, in oil, by exhibitor, Mrs. Sarah A. Mott, Coldwater	3 00
2d do., Mrs. E. F. Woodcock, Lansing	2 00
Best flower piece, in oil, by exhibitor, Grace W. Ford, Jackson	3 00
2d do., Miss Lulu A. Lane, Marshall	2 00
Best fancy painting, in oil, by exhibitor, Martha Buck, Lansing	3 00
2d do., Grace W. Ford, Jackson	2 00
Best fancy painting, in water colors, by exhibitor, Martha Buck, Lansing	3 00
Best landscape painting, in oil, of scenery in Michigan, by exhibitor, F. H. Hayward, Mt. Clemens	5 00
2d do., Miss Lulu A. Lane, Marshall	3 0
Best marine scene, in oil, by exhibitor, Kittie L. Holbrook, Lansing	3 00
2d do., Ella Wilcox, Lansing	2 00
Best painting on porcelain, W. A. Johnson, Lansing	3 00
2d do., Mrs. O. A. Jenison, Lansing	2 00
Best specimen painting on plaque, Mrs. E. C. Chapin, Lansing	3 00
2d do., Mrs. Sarah A. Mott, Coldwater	2 00
Best crayon drawing of face, Martha Buck, Lansing	3 00
2d do., Alexander Hahn, Lansing	2 00
Best crayon drawing of animal, Martha Buck, Lansing	3 00
2d do., Ella G. Rutter, Lansing	2 00
Best crayon drawing of landscape, Grace W. Ford, Jackson	1 00
Best drawing of any animal on grounds, F. H. Hayward, Mt. Clemens	3 00
Best drawing of any building on grounds, F. H. Hayward, Mt. Clemens	3 00
Best India ink drawing, W. S. Plumb, Lansing	3 00
2d do., W. A. Johnson, Lansing	2 00
Best pencil drawing of animal, Mrs. E. C. Chapin, Lansing	2 00
Best pencil drawing of landscape, Mrs. E. C. Chapin, Lansing	2 00
Best pencil drawing, by a person under 16 years of age, any subject, Mrs. E. C. Chapin, Lansing	2 00
2d do., Jessie Ballard, North Lansing	1 00

L. D. WATKINS,
CHAS. S. HATHAWAY,
S. L. WISE,
Judges.

NOT ENUMERATED.

Best cork painting, Mrs. Henry Moot, De Witt	$2 00
Best 2 landscape paintings, by exhibitors 14 and 13 years of age, Ella Wilcox, Lansing	1 00
Best winter piece, in oil, by exhibitor 14 years of age, Ella Wilcox, Lansing	1 00
Best etching in indelible ink, Mrs. E. C. Chapin, Lansing	2 00
Best collection, Mrs. Sarah A. Mott, Coldwater	5 00

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Best drawing of any animal on grounds, H. S. Bullock, Detroit	$3 00
Best drawing of any building on grounds, H. S. Bullock, Detroit	3 00
Best collection of india ink and pencil drawings, John B. Potter, Lansing	5 00
Best portrait in oil, Julius E. Ulber, Detroit	3 00
Best portrait in printers' ink, Julius E. Ulber, Detroit	3 00

L. D. WATKINS.
S. L. WISE,
CHAS. S. HATHAWAY,
Judges.

DIVISION O—NEEDLE AND FANCY WORK.

CLASS 59—ARTICLES OF LADIES' DRESS.

Best corset, Excelsior Corset Works, Detroit	$2 00

MISS CLARA L. WESCOTT,
MRS. H. E. JOHNSON,
Judges.

CLASS 60—PLAIN NEEDLE AND MACHINE WORK.

Best braiding, by hand sample, Mrs. E. C. Chapin, Lansing	$1 00
2d do., Lizzie Sheppard, Warrenton, Va.	50
Best fine shirt, all by hand, Mrs. B. F. King, Lansing	2 00
2d do., by machine, Mrs. M. E. Bartlett, Tompkins Centre	1 00
Best hemstitching, specimen, Mrs. E. C. Chapin, Lansing	2 00
2d do., Mrs. L. E. Terrill, Lansing	1 00
Best pair plain handkerchiefs, by hand, Mrs. B. F. Forbes, Kalamazoo	50
Best pair plain sheets, by hand, Julia Nagle, Lansing	1 00
2d do., Mrs. B. F. King, Lansing	50
Best quilt, calico patchwork, by hand, Geo. Smith, Lansing	2 00
Best quilt, silk patchwork, by hand, Julia Nagle, Lansing	3 00
2d do., Mrs. A. S. Horton, Eden	2 00
Best quilt, crazy, by hand, Mrs. L. Cottington, Lansing	3 00
2d do., Mrs. W. M. Colby, Lansing	2 00

MISS CLARA L. WESCOTT,
MRS. H. E. JOHNSON,
Judges.

CLASS 61—EMBROIDERY AND ORNAMENTAL NEEDLE WORK.

Best applique embroidery, in silk or velvet, Mrs. Sarah A Mott, Coldwater	$2 00
2d do., Mrs. Frank Stebbins, Adrian	1 00
Best arasene embroidery, specimen, Mrs. J. W. Garlick, Lansing	2 00
2d do., Mrs L. Cottington, Lansing	1 00
Best chenille embroidery, specimen, Mrs. L. Cottington, Lansing	1 00
Best crewel embroidery, specimen, Ella G. Rutter, Lansing	2 00
Best Kensington embroidery, specimen, Mrs. D. F. Woodcock, Lansing	2 00
2d do., Mrs. L. Cottington, Lansing	1 00
Best silk embroidery, specimen, Mrs. L. Cottington, Lansing	2 00
2d do., Mrs. J. W. Garlick, Lansing	1 00
Best collection of embroidery, done by one person, Mrs. Frank Stebbins, Adrian	6 00
2d do., Mrs. J. Brown, St. Johns	4 00
Best embroidered banner, Mrs. Frank Stebbins, Adrian	2 00
2d do., Mrs. L. Cottington, Lansing	1 00
Best embroidered chair or ottoman cover, in worsted, Mrs. E. C. Chapin, Lansing	1 00
Best embroidered chair or ottoman cover, in silk, Mrs. W. B. Kirby, Lansing	2 00
2d do., Charlotte Lewis, Lansing	1 00
Best embroidered foot rest, Mrs. W. B. Kirby, Lansing	1 00
2d do., Mrs. L. Cottington, Lansing	50
Best embroidered fire screen, in silk or worsted, Mrs. Frank Stebbins, Adrian	3 00
2d do., Charlotte Lewis, Lansing	2 00
Best embroidered infant's blanket, in silk, Mrs. W. B. Kirby, Lansing	2 00

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Best embroidered infant's dress or skirt, in silk, Mrs. W. B. Kirby, Lansing	$2 00
Best embroidered letters, in silk, Mrs. W. B. Kirby, Lansing	1 00
2d do., Mrs. J. W. Garlick, Lansing	50
Best embroidered lady's dress or cloak, in silk, Charlotte Lewis, Lansing	3 00
2d do., Mrs. J. W. Garlick, Lansing	1 00
Best embroidered pillow shams, in cotton or linen, Mrs. W. B. Kirby, Lansing	2 00
2d do., Mrs. E. C. Chapin, Lansing	1 00
Best embroidered piano or table cover, Mrs. Frank Stebbins, Adrian	4 00
2d do., Mrs. J. W. Garlick, Lansing	2 00
Best embroidered sofa pillow, in silk, Mrs. Frank Stebbins, Adrian	3 00
2d do., Mrs. J. W. Garlick, Lansing	1 00
Best embroidered sofa pillow, in worsted, Mrs. H. C. Hahn, Lansing	2 00
Best embroidered tidy, in silk, Mrs. Frank Stebbins, Adrian	2 00
2d do., Lizzie Sheppard, Warrenton, Va.	1 00
Best embroidered toilet set, Mrs. Wm. Hessler, Lansing	2 00
2d do., Mrs. A. S. Thompson, Lansing	1 00
Best embroidered table scarf, Mrs. L. A. Taft, Mendon	2 00
2d do., Miss Aurelia Thoman, Lansing	1 00
Best embroidered bag, Mrs. Frank Stebbins, Adrian	1 00
2d do., Mrs. L. Cottington, Lansing	50
Best etching in cotton, linen or silk, specimen, Mrs. Frank Stebbins, Adrian	2 00
2d do., Lizzie Sheppard, Warrenton, Va.	1 00
Best collection of lace work, Ella G. Rutter, Lansing	3 00
3d do., Mrs. H. C. Hahn, Lansing	2 00
Best Honiton lace, specimen, W. Waldby Cortland, Lansing	3 00
Best drawn work, specimen, Mrs. N. F. Jenison, Lansing	2 00
2d do., Mrs. E. F. Woodcock, Lansing	1 00
Best drawn work, sideboard cover, in linen, Mrs. N. F. Jenison, Lansing	3 00
2d do., Mrs. E. F. Woodcock, Lansing	2 00
Best darned net work, pillow sham and bed spread, Mrs W. Hessler, Lansing	2 00
Best etching in cotton, linen or silk, specimen, Mrs. E. C. Chapin, Lansing	2 00
Best fancy pin cushion, Mrs. Frank Stebbins, Adrian	1 00
2d do., Mrs. E. F. Woodcock, Lansing	50
Best fancy work bag, Mrs. W. B. Kirby, Lansing	1 00
Best fancy apron, Mrs. Frank Stebbins, Adrian	1 00
2d do., Mrs. A. Ayers, Lansing	50
Best home-made rug, drawn, W. K. Sexton, Howell	2 00
2d do., Mrs. C. Clement, Adrian	1 00
Best macrame work, specimen, Mrs. H. C. Hahn, Lansing	2 00
2d do., Mrs. Sarah A. Mott, Coldwater	1 00
Best mantel lambrequin, Mrs. J. W. Garlick, Lansing	2 00
2d do., Mrs. L. Cottington, Lansing	1 00
Best rickrack specimen, Lizzie Sheppard, Warrenton, Va.	1 00
2d do., Mrs. M. E. Bartlett, Tompkins Center	50
Best raised work sample, Mrs. E. C. Chapin, Lansing	1 00
2d do., Mrs. A. Ayers, Lansing	50

MRS. D. F. WOODCOCK,
MRS. S. H. KNIGHT,
Judges.

CLASS 62—CROCHET, KNIT AND FANCY WORK.

Best afghan robe, Mrs. E. A. Gilkey, Lansing	$4 00
2d do., Mrs. C. S. Brooks, Lansing	3 00
Best bedspread, crochet or knit, Mrs. Fannie Butler, Dimondale	3 00
2d do., Ella G. Rutter, Lansing	2 00
Best cotton tidy, Mrs. F. C. Chapin, Lansing	2 00
2d do., Mrs. M. E. Bartlett, Tompkins Center	1 00
Best child's shirt, crochet or knit, Carrie H. Choate, Jackson	2 00
2d do., Lizzie Sheppard, Warrenton, Va.	1 00
Best collection of work in this class made by one person, Mrs. Philip Bennett, Charlotte, Mich.	5 00
2d do., Mrs. C. Clement, Adrian	3 00
Best fancy mittens, crochet or knit, Mrs. M. E. Bartlett, Tompkins Center	2 00
2d do., Carrie H. Choate, Jackson	1 00

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Best hood, crochet or knit, Carrie H. Choate, Jackson	$2 00
Best infant's shoes, crochet or knit, Carrie H. Choate, Jackson	1 00
2d do., Lizzie Sheppard, Warrenton, Va.	50
Best leggins, crochet or knit, Lizzie Sheppard, Warrenton, Va.	2 00
Best ladies' shoes, crochet or knit, Mrs. L. A. Taft, Mendon	1 00
2d do., Miss Alice Dean, Lansing	50
Best skirt, crochet or knit, Miss M. J. Weaver, Ionia	2 00
2d do., Carrie H. Choate, Jackson	1 00
Best shawl, crochet or knit, Mrs. E. C. Chapin, Lansing	3 00
2d do., E. Beaubian, Lansing	2 00
Best trimming, worsted, crochet or knit, specimen, Lizzie Sheppard, Warrenton, Va.	50
Best trimming, in cotton or linen, crochet or knit, Lizzie Sheppard, Warrenton, Va.	1 00
2d do., Mrs. M. E. Bartlett, Tompkins Center	50
Best worsted tidy, Kittie L. Holbrook, Lansing	50

MISS CLARA L. WESTCOTT,
MRS. H. E. JOHNSON,
Judges.

NOT ENUMERATED.

Best display of corsets, Excelsior Corset Works Detroit	$3 00
Best crochet collar, E. Beaubian, Lansing	50

MISS CLARA L. WESTCOTT,
MRS. H. E. JOHNSON,
Judges.

Best infant's robe, Mrs. Sarah A. Mott, Coldwater	$1 00
Best embroidered fire-screen, in silk, Miss Aurelia Thoman, Lansing	1 00
Best traveling bag, Mrs. E. C. Chapin, Lansing	1 00
Best basket paper flowers, Bessie Bellankamp, Norville	50
Best alliance embroidery, Mrs. Frank Stebbins, Adrian	2 00

MRS. D. F. WOODCOCK,
S. H. KNIGHT,
Judges.

DIVISION P—MISCELLANEOUS.

CLASS 64—MISCELLANEOUS ARTICLES.

Best building stone, collection, Harvey, Harris & Co., Lansing	$3 00
Best concrete or artificial stone, specimen, C. W. Stevens, Lansing	2 00
Best monumental work, collection, Harvey, Harris & Co., Lansing	10 00
Best work in marble, W. H. Kline, Lansing	5 00

WM. H. WIGGINS,
S. W. CURTISS,
Judges.

CLASS 65—HOUSEHOLD ARTICLES.

Best clothing dryer, J. S. Valentine, Lansing	$1 00
Best fruit dryer, S. E. Oviatt, Lansing	5 00
Best fruit boxes, for grapes and other small fruits, A. W. Jewett, Mason	1 00

WM. H. WIGGINS,
S. W. CURTISS,
Judges.

DIVISION Q—CHILDREN'S DEPARTMENT.

Best specimen hand sewing, Miss A. Bundage, North Lansing	$2 00
2d do., Miss Chapin, Lansing	1 00
Best specimen darning, Miss A. Bundage, North Lansing	50
Best calico dress, by hand, Emma Nagle, Lansing	1 00
Best etching, in cotton or linen, Frankie Farrand, Lansing	1 00

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Best sample crochet work, Emma Nagle, Lansing	$1 00
2d do., Florence Moon, Lansing	50
Best doll's wardrobe, Miss A. Bundage, North Lansing	2 00
Best specimen painting on wood, Eva Harper, Battle Creek	1 00
Best display wax work, Ora B. Dunlap, Lansing	1 00
Best collection of pressed flowers, Julia Nagle, Lansing	1 00
Best bouquet wild flowers, Emma Nagle, Lansing	50
Best collection of postage stamps, Miss Chapin, Lansing	1 00
Best button string, Emma Nagle, Lansing	50
Best sample canned fruit, Miss Overholt, Eden	1 00
2d do., Florence Moon, Lansing	50
Best sample jelly, Florence Moon, Lansing	1 00
Best specimen penmanship, Emma Nagle, Lansing	1 00

NOT ENUMERATED.

Best crazy quilt, in silk, Mabel Wallace, North Lansing	2 00
Best pair pillow cases, Gertrude S. Gladden, Lansing	1 00

M. P. ANDERSON,
Judge.

DIVISION R—FRUITS AND FLOWERS.

CLASS 1—ARTISTIC EXHIBITS OF HORTICULTURAL PRODUCTS.

Most artistic and attractive arrangement of fruits, flowers, vegetables, plants, etc., to occupy 10 feet of side wall, A. W. Jewett, Mason	$30 00
2d do., Davis Bros., Jackson	20 00
Most artistic and attractive arrangement of fruits, flowers, plants, vegetables, etc., to occupy 4 feet square of table space, or same area wall space, to be gathered and arranged by a girl or boy under 15 years of age, Henry E. Ballard, Lansing	8 00

R. H. MANN,
ARTHUR P. GREEN,
Judges.

CLASS 2—GENERAL COLLECTION OF FRUITS FOR FAMILY USE.

Most judiciously selected, best grown, and carefully handled general collection of fruits, of not less than 25 nor more than 100 varieties, by individual or society, C. P. Chidester, Battle Creek	$40 00
2d do., F. H. Parker, Eaton Rapids	30 00
Most judiciously selected, etc., as above, grown by the exhibitor, C. P. Chidester, Battle Creek	30 00
2d do., D. L. Garver, Hart	20 00

PROF. L. R. TAFT,
Judge.

CLASS 3—GENERAL COLLECTION OF MARKET FRUITS.

Most judiciously selected, best grown and carefully handled general collection of market fruits, by individual or society, F. H. Parker, Eaton Rapids	$15 00

PROF. L. R. TAFT, *Judge.*

CLASS 4—SPECIAL EXHIBIT OF APPLES FOR DESSERT AND CULINARY PURPOSES

Most judiciously selected, best grown and carefully handled exhibit of not more than 35 varieties of apples, exhibited by individual or society, F. H. Parker, Eaton Rapids, Mich	$10 00
Most judiciously selected, best grown and carefully handled exhibit of 20 varieties of strictly dessert apples, by individual or society, C. P. Chidester, Battle Creek	8 00
2d do, F. H. Parker, Eaton Rapids	5 00

PROF. L. R. TAFT, *Judge.*

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CLASS 5—SPECIAL EXHIBIT OF MARKET APPLES.

Most judiciously selected, best grown and carefully handled exhibit of 15 varieties of market apples, grown by exhibitor, Frank McGuffie, Leslie	$6 00
Most profitable, best grown and carefully handled single peck of a variety of market apples, grown by exhibitor, Frank McGuffie, Leslie	2 00
2d do., John Howard, Grand Ledge	1 00

PROF. L. R. TAFT, *Judge.*

CLASS 6—SPECIAL EXHIBIT OF PEACHES.

Most judiciously selected, best grown and carefully handled exhibit of not less than 12 varieties of peaches, exhibited by individual or society, F. H. Parker, Eaton Rapids	$15 00
2d do., C. P. Chidester, Battle Creek	8 00
Most judiciously selected, best grown and carefully handled exhibit of 8 varieties of peaches for market, grown by exhibitor, W. S. Gebhart, Mears	8 00

JOSEPH LANNIN,
ELWOOD GRAHAM,
Judges.

CLASS 7—SPECIAL EXHIBIT OF PEARS.

Most judiciously selected, best grown and carefully handled exhibit of not more than 20 varieties of pears, by individual or society, Jos. Lannin, South Haven	$15 00
2d do., Jos. Lannin, South Haven	8 00
Most judiciously selected, best grown and carefully handled exhibit of 12 varieties pears for market, grown by exhibitor, Jos. Lannin, South Haven	8 00
2d do., Jos. Lannin, South Haven	5 00
Most profitable, best grown and carefully handled exhibit of 1 peck of a single variety of pears for market, grown by exhibitor, Jos. Lannin	2 00

R. GRAHAM, *Judge.*

CLASS 8—SPECIAL EXHIBIT OF PLUMS, 12 SPECIMENS OF EACH.

Most judiciously selected, best grown and carefully handled exhibit of not more than 12 varieties of plums, by individual or society, W. S. Gebhart, Mears	$5 00
Most judiciously selected, best grown and carefully handled exhibit of 6 varieties of plums, grown by exhibitor, D. L. Garver, Hart	5 00
2d do., W. S. Gebhart, Mears	3 00

JOS. LANNIN, *Judge.*

CLASS 9—SPECIAL EXHIBIT OF GRAPES.

Most judiciously selected, best grown and carefully handled exhibit of not more than 10 varieties of native grapes, grown in open air, by individual or society, C. P. Chidester, Battle Creek	8 00
2d do., A. Sigler, Adrian	5 00
Most judiciously selected, best grown and carefully handled exhibit of 6 varieties of native grapes, grown in open air, by exhibitor, C. P Chidester, Battle Creek	5 00

JOS. LANNIN,
ELWOOD GRAHAM,
Judges.

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CLASS 10—SINGLE PLATES OF FRUIT.

Apples.

Best plate Baldwins, C. P. Chidester, Battle Creek	$0 75
2d do., E. Graham, Grand Rapids	50
Best plate Bailey Sweet, C. P. Chidester, Battle Creek	75
Best plate Chenango, Frank McGuffie, Leslie	75
2d do., R. H. Holmes, Lansing	50
Best plate Early Joe, C. P. Chidester, Battle Creek	75
Best plate Early Strawberry, E. Graham, Grand Rapids	75
2d do., C. P. Chidester, Battle Creek	50
Best plate Grimes' Golden, E. Graham, Grand Rapids	75
2d do., C. D. Chidester, Battle Creek	50
Best plate Hawley, Darwin Foster, Grand Ledge	75
2d do., Frank McGuffie, Leslie	50
Best plate Jeffries, E. Graham, Grand Rapids	75
Best plate Jonathan, C. P. Chidester, Battle Creek	75
Best plate Melon, C. P. Chidester, Battle Creek	75
Best plate Northern Spy, Frank McGuffie, Leslie	75
2d do., C. P. Chidester, Battle Creek	50
Best plate Oakland, C. P. Chidester, Battle Creek	75
Best plate Primate, C. P. Chidester, Battle Creek	75
Best plate Peck's Pleasant, Frank McGuffie, Leslie	75
2d do., C. P. Chidester, Battle Creek	50
Best plate Pomme Gris, D. L. Garver, Hart	75
2d do., C. P. Chidester, Battle Creek	50
Best plate Shiawassee, C. P. Chidester, Battle Creek	75
2d do., E. Graham, Grand Rapids	50
Best plate Sweet Bough, Mrs. A. Ayres, Lansing	75
2d do., C. P. Chidester, Battle Creek	50
Best plate Westfield, Frank McGuffie, Leslie	75
Best plate Yellow Bellflower, Thos. H. McCurdy, Lansing	75

Crabs.

Best plate Hyslop, Geo. W. Parks, Lansing	75
Best plate Transcendant, Geo. W. Parks, Lansing	75
2d do., Frank McGuffie, Leslie	50

JOSEPH LANNIN,
ELWOOD GRAHAM,
Judges.

Pears.

Best plate Boussock, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Bosc, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Bartlett, Jos. Lannin, South Haven	75
2d do., Darwin Foster, Grand Ledge	50
Best plate Beurre d' Anjou, Joseph Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Clapp's Favorite, R. H. Holmes, Lansing	75
2d do., R. H. Holmes, Lansing	50
Best plate Flemish Beauty, Jos. Lannin, South Haven	75
2d do., R. H. Holmes, Lansing	50
Best plate Gray Doyenne, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Howell, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Louise Bonne de Jersey, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Lawrence, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50

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Best plate Lucrative, Jos. Lannin, South Haven	$0 75
2d do., Jos. Lannin, South Haven	50
Best plate Mount Vernon, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Nelis, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Seckel, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50
Best plate Sheldon, A. Sigler, Adrian	75
2d do., Jos. Lannin, South Haven	50
Best plate White Doyenne, Jos. Lannin, South Haven	75
2d do., Jos. Lannin, South Haven	50

ELWOOD GRAHAM, *Judge.*

Plums.

Best plate Damson, A. W. Jewett, Mason	$0 75
Best plate Englebert, W. S. Gebhart, Mears	75
Best plate Green Gage, W. S. Gebhart, Mears	75
Best plate Huling, W. S. Gebhart, Mears	75
Best plate McLaughlin, W. S. Gebhart, Mears	75
Best plate Red Egg, R. H. Holmes, Lansing	75
2d do., R. H. Holmes, Lansing	50
Best plate Shropshire, W. S. Gebhart, Mears	75
Best plate Union Purple, W. A. Gebhart, Mears	75
2d do., R. H. Holmes, Lansing	50

C. B. WALDRON,
H. P. GLADDEN,
Judges.

Quinces.

Best plate Orange, Ella Reeves, Lansing	$0 75
2d do., Geo. W. Parks, Lansing	50

C. B. WALDRON,
H. P. GLADDEN,
Judges.

Grapes.

Best plate Brighton, C. P. Chidester, Battle Creek	$0 75
Best plate Concord, C. P. Chidester, Battle Creek	75
Best plate Lady, C. P. Chidester, Battle Creek	75
Best plate Moore, C. P. Chidester, Battle Creek	75
Best plate Niagara, C. P. Chidester, Battle Creek	75
Best plate Worden, C. P. Chidester, Battle Creek	75

JOSEPH LANNIN,
ELWOOD GRAHAM,
Judges.

Peaches.

Best plate Barnard, W. S. Gebhart, Mears	$0 75
Best plate Cooledge, W. S. Gebhart, Mears	75

ELWOOD GRAHAM,
JOSEPH LANNIN,
Judges.

CLASS 11—DRIED, CANNED, PICKLED AND PRESERVED FRUITS AND JELLIES.

Best 8 glasses, named varieties, of domestic dried fruit, Mrs. B. F. Forbes, Kalamazoo	$8 00
2d do., Mrs. O. R. Rice, St. Johns	4 00

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Best 8 glasses, named varieties, of domestic canned fruit, Mrs. B. F. Forbes, Kalamazoo $10 00
2d do., A. Sigler, Adrian 6 00
Best 8 glasses, named varieties, of pickled fruit, Mrs. O. R. Rice, St Johns 6 00
2d do., Mrs. M. E. Bartlett, Tompkins Centre 4 00
Best 8 glasses, named varieties, of domestic preserved fruits, Mrs. B. F. Forbes, Kalamazoo 6 00
2d do., Mrs. M. E. Bartlett, Tompkins Centre 4 00
Best 10 glasses, named varieties, of domestic jellies, Davis Bros., Jackson 8 00
2d do., Mrs. M. E. Bartlett, Tompkins Centre 5 00

C. L. WHITNEY,
MRS. G. F. GILLAM,
MRS. F. H. ADAMS,
MRS. J. M. DRESSER,
Judges.

CLASS 12—PLANTS AND FLOWERS, SHOWN IN BEDS.

Best and most tastefully arranged ribbon bed of flowers, in strips or ribbons, R. Mann & Son, Lansing $12 00

C. L. WHITNEY,
MRS. G. F. GILLAM,
MRS. J. M. DRESSER,
MRS. F. H. ADAMS,
Judges.

CLASS 13—PLANTS IN POTS—PROFESSIONAL LIST.

Best and largest collection of green-house and stove plants, named, not less than 30 varieties, R. Mann & Son, Lansing $20 00
Best 6 double geraniums, different colors, in flower, R. Mann & Son, Lansing 2 00
Best 6 single geraniums, different colors, in flower, R. Mann & Son, Lansing 2 00
Best 6 winter flowering begonias, in bloom, R. Mann & Son, Lansing 2 00
Best specimen fern, R. Mann & Son, Lansing 1 00

MRS. DR. BAKER,
MRS. E. H. WHITNEY,
Judges.

CLASS 14—PLANTS IN POTS, AMATEUR LIST.

Best specimen plant, in bloom, of Abutilon, Ella Reeves, Lansing $1 00

MRS. DR. BAKER,
MRS. E. H. WHITNEY,
Judges.

CLASS 15—CUT FLOWERS, BOUQUETS, AND FLORAL DESIGNS.

Best and most tasteful display of cut flowers, Col. T. S. Clark, Lansing $8 00
2d do., Mrs. G. C. Fuller, Lansing 4 00
Best 6 varieties of verbenas, different colors, cut flowers, Mrs. O. G. Tooker, North Lansing 2 00
2d do., Mrs. B. F. Forbes, Kalamazoo 1 00
Best 6 double dahlias, in bloom, different colors, Mrs. B. F. Forbes, Kalamazoo 2 00
Best 6 gladiolus, in bloom, different colors, M. Wetterling, Ionia 1 50
Best 6 Bourbon, or tea roses, in bloom, different colors, R. Mann & Son, Lansing 2 00
2d do., Mrs. B. F. Forbes, Kalamazoo 1 00
Best collection of pansies, in bloom, not less than 6 different colors, Col. T. S. Clark, Lansing 1 25
2d do., W. H. McKale, Lansing 75
Best and most tastefully arranged (by exhibitor) bouquet of living flowers, R. Mann & Son, Lansing 3 00
2d do., Mrs. B. F. Forbes, Kalamazoo 2 00

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Best and most tastefully arranged (by exhibitor) bouquet of dried grasses, M. Wetterling, Ionia	$2 00
Best and most tastefully arranged living flowers, in vases, Ella Reeves, Lansing	2 00
Best and most tastefully executed floral design (by exhibitor) in living flowers, R. Mann & Son, Lansing	10 00
2d do., Mrs. B. F. Forbes, Kalamazoo	7 00
Best and most tastefully arranged (by exhibitor) fancy basket of cut flowers, Mrs. B. F. Forbes, Kalamazoo	3 00
2d do., R. Mann & Son, Lansing	2 00

MRS. DR. BAKER,
MRS. E. H. WHITNEY,
Judges.

NOT ENUMERATED.

Collection of asters, W. H. McKale, Lansing	$1 00
Moss basket, fancy camp kettle, Mrs. E. H. Claflin, North Lansing	1 00

MRS. DR. BAKER,
MRS. E. H. WHITNEY,
Judges.

Display plums, D. L. Garver, Hart	$2 00
Display plums, W. S. Gebhart, Mears	5 00

C. B. WALDRON,
H. P. GLADDEN,
Judges.

Three fancy urns, Mabel E. Markey, North Lansing	$2 00

R. H. MANN,
ARTHUR P. GREEN,
Judges.

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REPORTS FROM LOCAL SOCIETIES.

BROCKWAY CENTER DISTRICT AGRICULTURAL SOCIETY.

YALE, ST. CLAIR CO., MICH.,
November 29, 1889.

To the Secretary of the State Agricultural Society:

DEAR SIR—The Brockway Center District Agricultural Society held its first annual fair on the grounds of the society September 25, 26 and 27, 1889.

219 membership tickets sold at $1 each	$219 00
Gate receipts	196 50
Rent of ground during fair	70 00
Total	$485 50
Amount of premiums awarded	270 00
Expenses	86 00
Total	$356 00

Number of entries, 730.

JOHN WARK,
Secretary.

ARTICLES OF ASSOCIATION OF THE BROCKWAY CENTER DISTRICT AGRICULTURAL SOCIETY.

To all whom it may concern:

We the undersigned inhabitants of the State of Michigan, desiring to form a district agricultural society, under the provisions of sections 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, and 2312, of the general statutes of the State of Michigan, compiled and annotated by Andrew Howell, and the provisions of this chapter 55, title 10, of revised statutes of 1846, and other laws applicable thereto, have associated ourselves together, and do associate ourselves together, under the provisions of the said statute laws of this State, as Brockway Center District Agricultural Society.

First, said society shall be composed of the following named townships situated in the counties of St. Clair, Sanilac and Lapeer, to wit: In St. Clair county, Brockway, Emmet, Grant, Greenwood, Lynn, Kenokee, Clyde, Mussey, Riley, Wales, Burchville and the village of Brockway Center. In Sanilac county, Flynn, Elk, Speaker, Freemont and Maple Valley. In Lapeer county, Burnside.

Place of business shall be the village of Brockway Center, St. Clair county.

The objects of and business of said society to be to promote the interest of agriculture, horticulture and mechanic arts, hold fairs and exhibitions, and at its pleasure distribute premiums for the best and most meritorious animals or articles exhibited in the several departments, and as shall by its by-laws be provided for.

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To have and use a common seal and change the same.

To purchase, hold, take and receive by gift, devise or otherwise, exempt from taxation, real estate for the purposes of its incorporation and none other, including farm or farming lands, not exceeding one hundred and sixty acres, for the use and benefit of said society, for the purpose of experimenting in the various branches of agriculture and horticulture and stock raising, not exceeding in value fifty thousand dollars, and personal estate not exceeding twenty thousand dollars.

To make all necessary by-laws, not inconsistent with the laws of this State or the United States, for the management of the business of said society.

To permit all persons who shall pay into the treasury of said society annually on or before the last Monday in January, 1890, the time fixed for first and subsequent annual meetings of said society, or any year thereafter, a sum of money not less than fifty cents, nor more than one dollar (and who shall subscribe the articles of association), to become a stockholder therein, and thereby entitling him to all the privileges and emoluments thereto belonging.

The officers of said society to consist of five or more directors, a president, secretary and treasurer, for the purpose of incorporating.

The following named persons are hereby selected and appointed to be the officers before mentioned, until the first annual meeting of said society, to be held on the last Monday in January, 1890: President, Elmore Putney; secretary, John Wark, treasurer, William Hodgins; directors, the following named persons: Jeremiah Johnson, Duncan McKenzie, Charles Lapine, Elston Huffman, Henry Kingsley, John Holden, Thomas Grimes, Peleg Soles, John H. Beckett.

Officers of said society to be elected for not less than the term of one year, nor for more than three years.

First and future elections of officers to be held on the last Monday in January in each year, and shall be elected by the stockholders of said society at the annual meeting before named; but vacancies occurring between the annual meetings may be filled by the board.

Said officers shall constitute a board for the management of the concerns of said society, a majority of whom shall be a quorum.

Five or more stockholders at any annual meeting may elect officers of said society.

Said society or association hereby reserving to itself all rights and privileges, conferred by statute of this State.

Dated Brockway Center, February 16, 1889.

ELMORE PUTNEY,
JOHN WARK,
WILLIAM HODGINS,
JOHN H. BECKETT,
THOMAS GRIMES,
DUNCAN McKENZIE,
JEREMIAH JOHNSON,
CHARLES A. LEPIEN,
HENRY KINGSLEY,
DANIEL FOLEY,
Associates in Incorporation.

STATE OF MICHIGAN, } ss.
County of St. Clair. }

Be it remembered that on the 16th day of February, 1889, before me, a notary public, in and for said County of St. Clair, and State of Michigan, duly qualified under the laws of said State to take acknowledgments of deeds, personally appeared the foregoing named persons, to wit: Elmore Putney, John Wark, William Hodgins, John H. Beckett, Thomas Grimes, Duncan McKenzie, Jeremiah Johnson, Charles A. Lepien, Henry Kingsley and Daniel Foley, who in due form of law severally acknowledged the foregoing artices of association, by them subscribed, to be their free act and deed.

In witness whereof I have hereunto set my hand and affixed my official seal this 16th day of February, 1889.

[SEAL]

WILLIAM GOWAN,
Notary Public, St. Clair County, Michigan.

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BAY COUNTY AGRICULTURAL SOCIETY.

SECRETARY'S REPORT.

For some time it has been desired by the directors and members of the Bay County Agricultural Society that the location of the fair grounds be changed, as they were inaccessible on account of being a long distance from steam and horse cars, besides being guarded on either side by toll gates, which made it objectionable to all concerned. At a meeting of the agricultural society February 15, 1888, it was unanimously decided to change the location.

The said grounds were held in trust in Bay county for the use and benefit of the society. A committee was appointed by the society to confer with a committee of the board of supervisors of Bay county for the purpose of changing the location. The committee of the agricultural society had options on the following pieces of property for new grounds, viz.: One from T. B. Donnelly of a piece of land owned by W. D. Fitzhugh, situated east of the Michigan Central railroad and north of Center avenue, at $150 per acre. One from T. H. McGraw at South Bay City, at same price. Also one from Mrs. Turbush of West Bay City, at $200 per acre. At a conference of the committees the the following report to the board of supervisors was agreed upon:

"After looking over all of the propositions for locations, we would recommend that the proposition of T. B. Donnelly be accepted, and that the agricultural society secure at least forty (40) acres. We would further recommend that the agricultural society be authorized to sell the present grounds owned by the county at the best price possible as soon as practicable and apply the proceeds on payment of the new grounds."

The above report was accepted by the Board of Supervisors January 12, 1889. The agricultural society in February last purchased the location recommended by the Board of Supervisors, containing forty-five acres of ground, upon which $2,000 has been paid. Clearing, draining and other improvements to the amount of $2,155.27 have been made. The present grounds on Center avenue are admirably located, as the Michigan Central railroad will have a station adjoining them. The Bay City belt line will soon be built with a station on the other side, and the Bay City street railway line runs directly to the entrance, which will enable people from all parts of the city, South and West Bay City, to reach the grounds easily. The new half-mile track has been commenced, and when completed will be one of the best in the State. The committee has under consideration plans for new buildings which will be entirely unlike any other in the West, and will excel any in this section of the State for convenience and general adaptability. The grounds, with all of the appurtenances, will be ready for occupation in time for the next annual fair in 1890.

W. F. BRACE,
Secretary.

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TREASURER'S REPORT FOR THE YEAR ENDING DECEMBER 18, 1889.

Receipts.

Cash on hand, Dec. 18, 1889	$2,319 75
Received from county tax, 1888	1,482 13
Membership fees, 1889	192 75
Receipts at fair	754 84
Rent, sale of shafting, etc	105 00
Interest	70 00
$700 note discounted, net	687 33
Total	$5,611 80

Disbursements.

Paid on new grounds	$2,000 00	
Premiums and expenses of fair, 1889	1,355 01	
Improvements on new grounds	2,155 27	
Total		5,510 28
Cash on hand		$101 52

Respectfully submitted,

E. R. PHILLIPS,
Treasurer.

We hereby certify the above to be a statement of the receipts and disbursements of the Bay County Agricultural Society for the year ending December 18, 1889.

C. B. CHATFIELD,
President.
W. F. BRACE,
Secretary.

MANISTEE COUNTY AGRICULTURAL SOCIETY.

This society held its twelfth annual fair at Onekama, September 18 to 22, 1888.

Balance on hand	$256 59
Receipts from fair	646 10
Rent of ground	20 00
County treasurer (per action board of supervisors)	256 71
	$1,179 40

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Paid premiums	$315 20	
Printing	93 49	
Gatekeepers and clerks	24 00	
Salaries	55 00	
Improvement of grounds, building track, etc.	534 96	
		$1,022 65
Balance		$156 75

OFFICERS FOR ENSUING YEAR.

President—Henry A. Danville, Marilla.
Secretary—John N. Brodie, Bear Lake.
Treasurer—Leo F. Hale, Bear Lake.

JOHN N. BRODIE,
Secretary.

BEAR LAKE, *January 12, 1889.*

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